NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**A**
Title	**STATION OPERATOR DATA MANAGEMENT RESPONSIBILITIES**
Effective Date	**JUNE 1994**

AUTHORIZATIONS		
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REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

SECTION A STATION OPERATOR DATA MANAGEMENT RESPONSIBILITIES

AeroVironment, Inc. (AV) serves as the Data Processing Center Contractor (DPC) for the National Park Service (NPS) Air Quality Division (AQD). The DPC performs data validation of raw data, prepares preliminary and final data reports, and stores the NPS gaseous pollutant, meteorological, and fine particle historical databases (along with emissions inventories from selected areas) for access by NPS/AQD staff. The DPC, in conjunction with the NPS Database Manager, submits the final data and precision and accuracy data into the EPA AIRS database.

Station operators are responsible for sending data packets to the DPC on a bi-monthly basis. The first data packet should contain all documentation corresponding to the data collected from the 1st day of the month through the 15th of the month, and the second data packet should contain all documentation corresponding to the data collected from the 16th day of the month through the end of the month. Both data packets must be sent to the DPC within a week following the end of the completed monitoring data period.

Section A includes the following sub-sections:

- A.1 - Data Handling and Record Keeping Overview
- A.2 - Station Operator Responsibilities

Sub-section A.1 describes the three levels of data and focuses on the second level, preliminary data. This section also explains the responsibilities of the DPC, the Monitoring Operations Support Contractor (OSC), and the station operator, and it emphasizes the importance of collecting and documenting data accurately.

Sub-section A.2 describes the materials and processes used by the station operator for completing data packets. It is organized into sub-sections; each sub-section describes a specific document that is to be completed by the station operator and included in the data packet when it is sent to the DPC. The sub-sections also outline the station operator's activities and give additional information about sending documentation to the DPC.

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**A.1**
Title	**DATA HANDLING AND RECORD KEEPING OVERVIEW**
Effective Date	**JUNE 1994**

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A.1 DATA HANDLING AND RECORD KEEPING OVERVIEW

Basically, there are three levels of data validation: raw, preliminary, and final.

Raw Data: Raw data is defined as data directly from the strip chart recorder or data logger that have not been checked for quality or completeness.

Preliminary Data: Preliminary data is defined as data that have been reviewed and passed preliminary screening. This covers a wide range of data with varying levels of validation, from daily summaries which have been reviewed by monitoring support personnel, to Monthly Preliminary Data Reports which are generated by the DPC.

Preliminary Reports. Preliminary reports are generated by the DPC on a monthly basis and are reviewed by station operators and by NPS/AQD personnel as part of the final data validation process. These data are traceable to a primary database (strip charts or data logger daily summaries). Missing data have been entered from strip charts and daily summaries, erroneously entered data have been deleted, and statistical evaluations have been completed.

Preliminary Data Reports. Preliminary data reports are prepared by the DPC based on the records sent bi-monthly from station operators. The first data packet contains all data collected from the 1st of the month through the 15th of the month, and the second data packet contains all data collected from the 16th of the month through the end of the month. Both data packets must be sent within a week following the end of the data period contained in the packet. Each data packet must include all information generated during normal site operations, including the following:

- Station Log Book Records
- Strip Charts
- Weekly Power Failure Logs
- Daily Summaries
- Weekly Station Checklists
- Weekly Zero/Span/Precision Check Forms (ZSP Forms)
- Maximum Hourly Average Concentration Verification Forms
- Multipoint Calibration Forms (Monthly)

In selected cases, it may be required to include the following information:

- Transfer standard certification information
- Performance audit data (from the State or NPS Contractor)
- Site systems audit data (from the State or NPS Contractor)

Station Log Book Records. Station log books must accurately reflect site operations and refer to all documents generated as a result of daily operations. This is the foundation of a complete and accurate database. Final data cannot be generated without this foundation. It takes a lot of work and money to collect data; it takes a little extra effort to make certain that the data are good so it can be used, reported, and defended, without reservation.

Strip Charts. Strip charts are considered to be the primary database for gaseous pollutant monitors since they provide a graphical record of instrument performance. Data loggers average the instrument's signal output and are often not a true representation of the quality of data collected. An example of this is a noisy instrument output. The strip chart will indicate an instrument malfunction, whereas the data logger

will average the signal and mask the problem. Also, instruments will often respond to 100% of the possible output (full scale) when power is re-established following even a brief power failure. The data logger will average this "peak" into the hourly average, whereas the strip chart will reflect the true average for the period.

Daily Summaries: The daily summaries (and preliminary data reports generated from polled data), although by no means complete, once screened by monitoring support personnel, may be used by researchers and resource management personnel to flag event occurrences.

The validation process requires that the polled data be compared to strip charts and to daily summaries generated on-site. Throughout the data validation process the data must maintain a "traceability link" and the transfer of the primary database must occur from the monitoring site, where it originated, to the DPC, where it will be validated, reported, and archived.

Control Forms. Since it is not practical to make photocopies of all strip charts, it is necessary for the station operator to complete the Weekly Zero/Span/Precision Check Form (ZSP Form) and Maximum Hourly Average Concentration Verification Form according to procedures in Section A.2. These procedures require the station operator to compare weekly Zero, Span, and Precision Event results, and the daily maximum hourly averages between the data logger and the strip chart recorder. In doing so, the "traceability link" is established between the strip chart and the daily summary printed from the data logger.

Other Documentation. All other documentation (daily summaries, Weekly Station Checklists, and Multipoint Calibration Forms) are easily photocopied. Prior to sending a packet of data, the site operator has used the ZSP Forms and Maximum Hourly Average Concentration Verification Forms to establish the "traceability link" between the daily summaries and the strip charts. Even if the primary site records are lost in transit to the DPC, no loss of data would occur.

The original documentation retained on-site also provides the monitoring site operator with the necessary information to comment on the monthly preliminary data report. These comments from the site operator are an important step in the validation of final data.

Final Data Reports: Final data reports are generated after the monthly preliminary data reports have been reviewed by monitoring site operators and NPS/AQD staff. Once the data is in final form, it is ready for submission into the EPA's Aerometric Information Retrieval System (AIRS) Database, where it may be accessed by EPA regional offices, state and local agencies, and research facilities nationwide. Final data reports are generated within 90-120 days after the end of the calendar year.

Final Validated Data: Final validated data is defined as data that have passed quality control and quality assurance tests, have been reviewed by both monitoring support personnel and site operators, and are ready to be archived into a permanent database. The Code of Federal Regulations requires that data used for regulatory purposes must be submitted into AIRS within ninety (90) days of collection.

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**A.2**
Title	**STATION OPERATOR RESPONSIBILITIES**
Effective Date	**DECEMBER 1994**

AUTHORIZATIONS		
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Other		

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0.1	12/94	Various revisions in tables and figures to ensure dates and data results in example documentation correspond. Reformatted page 3 as top 2 lines were missing.	John F. Faust

A.2 STATION OPERATOR RESPONSIBILITIES

Station operators are responsible for sending data packets to the DPC on a bi-monthly basis. The first data packet should contain all documentation corresponding to the data collected from the 1st day of the month through the 15th of the month, and the second data packet should contain all documentation corresponding to the data collected from the 16th day of the month through the end of the month. Both data packets must be sent to the DPC within a week following the end of the completed monitoring data period. These data packets must include all information generated during the monitoring data period and under normal site operations, including:

A.2.1 - The yellow copies of completed station log book pages (the pink copy goes to the OSC)
A.2.2 - Copies of Power Failure Logs
A.2.3 - Reviewed and annotated Strip Charts
A.2.4 - Copies of Weekly Zero/Span/Precision Check Form (ZSP Form), and Maximum Hourly Average Concentration Verification Forms
A.2.5 - Copies of Daily Summaries
A.2.6 - Copies of Weekly Station Checklists
A.2.7 - Copies of Calibration Forms (if applicable)
A.2.8 - Back-up Documentation (if applicable)

NOTE: When the data packet is received by the DPC, a postcard will be sent back to you acknowledging the receipt of the packet.

> If this postcard is not received within 2 weeks of your sending the data packet, notify the DPC before sending any additional data packets.

A.2.1 Station Log Book

The station log book must accurately reflect all site activities, document all telephone conversations with monitoring support personnel, and refer to all documents generated as a result of daily operations.

ACTIVITIES:

1) Document all observations and activities in the station log book. Please note that all entries are to be made in Local Standard Time (LST). See Figure A.2-1, Sample Station Log Book Entry, for an example.

   Useful observations include station log notes regarding the current weather conditions at your site. Helpful observations include:

   - cloud cover (clear, scattered, cumulus, etc.);
   - wind information (northerly winds, calm, windy, etc.);
   - relative temperatures (cold, cool, warm, etc.);
   - humidity (dry, comfortably humid, etc.);
   - precipitation events (rain this morning, snowing at present time, forecast for snow this evening); and/or
   - prescribed burns or wild fires, local road construction, or similar disturbance
   - any comments regarding significant meteorological events since the last station visit (high winds on Thursday, February 4, thunderstorms last night, heavy snowfall last two days, etc.).

Station BADL Page 37
Station Operator J. Smith

National Park Service Air Quality Monitoring Station Log

Date	Time	Action	Station Operator
12/10/92	0540 CST	[ ] Continued from previous page J. Smith in station for weekly station check. Scattered clouds, light winds out of the north, cool.	J Smith
	0545	Changed strip chart paper.	
	0600	Printing daily summaries.	
	0618	Performing station check.	
	0620	Downed 03 & cal.	
	0625	Upped 03 & cal.	
	0634	Downed all met parameters.	
	0655	Upped all met, no adjustments were made.	
	0701	Printed power failure log.	
	0705	Checked sumx & strip chart time, no adjustments were made.	
	0725	Power failure.	
	0809	Power restored after 44 minutes.	
	0910	Reset strip chart time.	
	0915	Called Air Resource Specialists to order sample inlet filters.	
	0948	Downed ozone & cal for filter change.	
	1006	Upped ozone & cal after filter change old filter was unusually dirty. There have been some grass fires in the park that may have contributed to the debris.	
	1025	Started an ozone span to condition filter for 30 minutes.	
	1225	Completed control charts & check lists.	
	1230	J. Smith departing station.	J. Smith
		REST OF PAGE INTENTIONALLY LEFT BLANK.	
		[ ] Continued on following page	

White Copy - to remain in station notebook Yellow Copy - to DPC Pink Copy - to Monitoring Support Contractor

Figure A.2-1. Sample Station Log Book Entry.

These types of observations will help evaluate the overall performance of all air quality and meteorological equipment and provide the NPS with additional confidence in the quality of the reported data.

It is also important to document all site activities in the station log book. This includes all maintenance performed, observations on analyzer/sensor performance, and any other information you feel is important. It is extremely useful to note the times that specific columns (data logger inputs) are "down" (taken off line) during station checks. This will help the DPC to check the overall system performance and to know the validity of the reported values are indeed valid.

Example station log book entry:

Date	Time	Action	Station Operator
11/14/92	*1514* *1524* *1530*	*Columns 4-9 down.* *Columns 4-9 up.* *Tipped precipitation bucket 10 times to check system performance and accuracy.*	*J. Smith*

2) Make certain that both "COPY" pages are legible. Place the stiff piece of cardboard provided along with the log book between the pages so additional copies are not made unintentionally.

3) Make certain that the station name is legible on the original and on the "COPY" pages of the station log book.

4) Note the spaces to check "Continued From Previous/On Following Page" at the upper left and lower right corners of the station log book page.

5) If a page has been partially left blank, note on the page "REST OF PAGE INTENTIONALLY LEFT BLANK."

6) Sign the log book each visit (first initial and full last name); this is especially important for stations with multiple operators.

SENDING DOCUMENTATION:

1) The station log books are set-up with 3-part carbonless log book pages. The original page will be maintained at the station. Both "COPY" pages are removed from the station log book and the yellow copy is sent in the bi-monthly packet to the DPC. The pink copy is sent directly to the OSC monthly.

2) Be certain that all station log book entries through the end of the month are included with the second data packet forwarded to the DPC.

A.2.2 Power Failure Logs

The SumX data logger has the ability to record the ten (10) most recent power failures. This power failure log is necessary to document times and durations of power failures on strip charts (see Figure A.2-2, Sample SumX Data Logger Power Failure Log).

POWER FAILURES 13:15:12 12/10/92 BADLANDS NP

	FROM			TO		
01	07:25:03	12/10/92	345	08:10:06	12/10/92	345
02	07:20:21	11/05/92	310	07:20:26	11/05/93	310
03	05:47:06	11/05/92	310	05:47:11	11/05/93	310
04	05:56:46	10/30/92	304	05:56:51	10/30/93	304
05	00:24:03	10/24/92	298	00:24:08	10/24/93	298
06	00:14:04	09/24/92	298	00:14:09	09/24/93	298
07	19:46:34	09/16/92	260	19:46:38	09/16/93	260
08	05:03:57	09/09/92	253	05:04:02	09/09/93	253
09	19:21:53	08/07/92	220	19:21:58	08/07/93	220
10	11:06:01	07/27/92	209	11:06:05	07/27/93	209

>

Figure A.2-2. Sample SumX Data Logger Power Failure Log.

ACTIVITIES:

1) The power failure log is printed by the site operator while performing the Weekly Station Checklist.

2) Make absolutely certain that legible copies can be made if necessary.

SENDING DOCUMENTATION:

1) The monitoring station operator has the option of either generating two copies of both the daily summaries and power failure log while performing the weekly station check, or making photocopies of the printouts generated during the site visit. A legible copy must be forwarded to the DPC and the original must be maintained at the monitoring station as a back-up in the event that the bi-monthly data packet is lost, and as material for the station operator's review of the Preliminary Monthly Data Report.

2) The original copy of each power failure log will be kept at the station. Send a legible copy of each power failure log in the bi-monthly packet to the DPC.

A.2.3 Strip Charts

Strip charts are considered to be the primary database for gaseous pollutant monitors since they provide a graphical record of instrument performance. The station operator will need to review and annotate strip charts, noting power failures, abnormal hourly averages, unusual chart traces, etc. Notes should be entered on the chart paper so as to not interfere with any chart data recordings (see Figures A.2-3a and A.2-3b).

ACTIVITIES:

1) Cut and remove the chart paper at 2400 (midnight) on the 15th of the month if you are preparing to send in the first bi-monthly data packet, or at 2400 (midnight) on the last day of the month if you are preparing to send in the second bi-monthly data packet. Make certain that the recorder has enough paper to last until the next scheduled station visit.

2) Annotate the beginning and end of each strip chart with the following (as in Figures A.2-3a and A.2-3b):

   - Operator's first initial and full last name;
   - Station name;
   - Chart Begins: (Date and Local Standard Time);
   - Chart Ends: (Date and Local Standard Time);
   - The equation used to determine ppm concentrations from % chart readings; and
   - If applicable, indicate which colors correspond to what parameters (O3, SO2, etc.) if the strip charts are multi-pen.

3) Annotate the date at the beginning and end of each 24-hour segment of the strip chart (see Figure A.2-3b). The starting time of the daily automatic Zero and Span should provide a good time reference.

4) Review the strip chart trace and identify all power failures listed on the power failure logs on the strip chart (see Figure A.2-2). NOTE ANY POWER FAILURES AND ANY PERIODS WHERE THE ACTUAL TIME DISAGREES WITH THE TIMES PRE-PRINTED ON THE CHART PAPER.

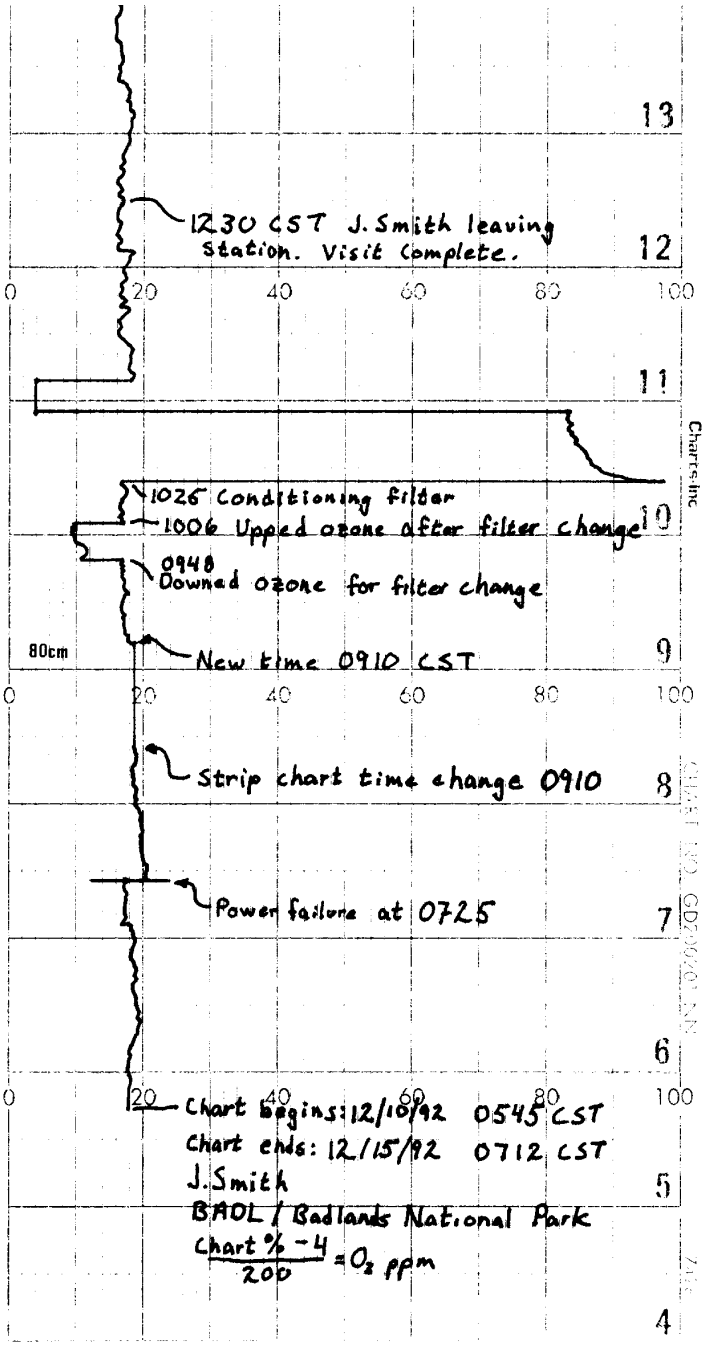

Figure A.2-3a. Sample Annotated Strip Chart Segment.

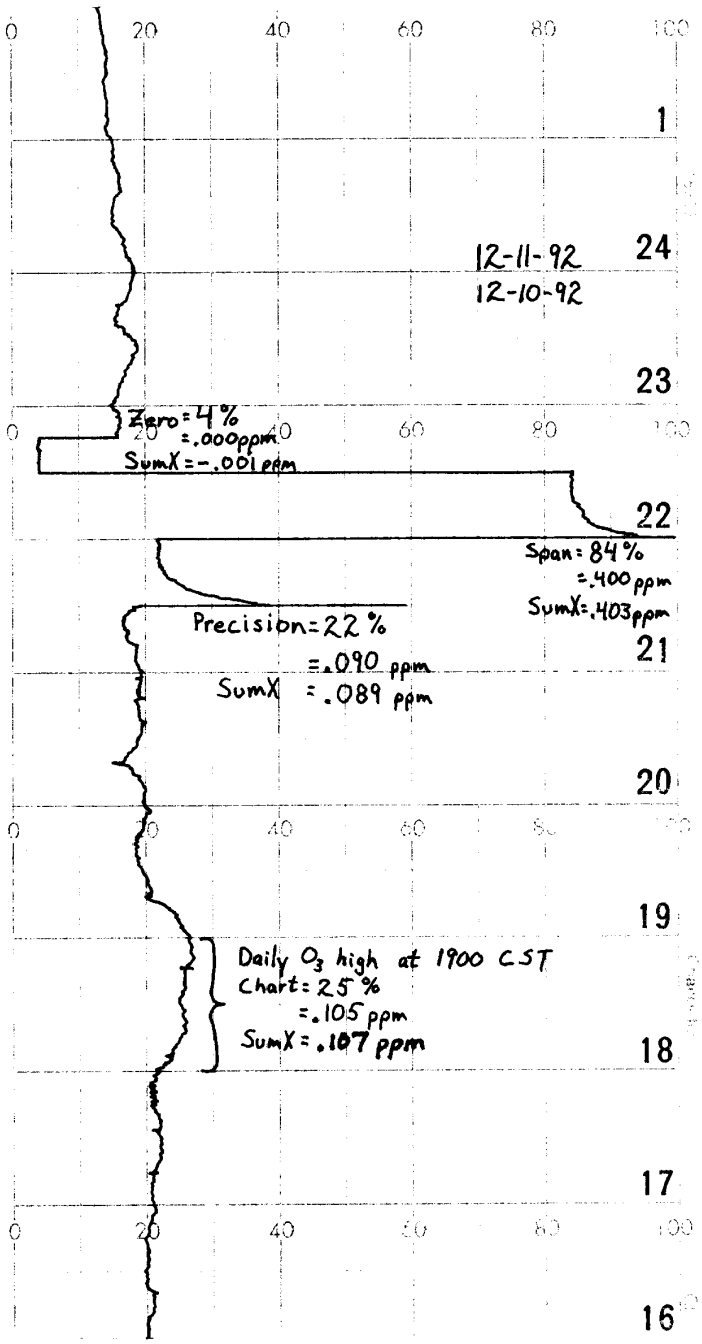

Figure A.2-3b. Sample Annotated Strip Chart Segment.

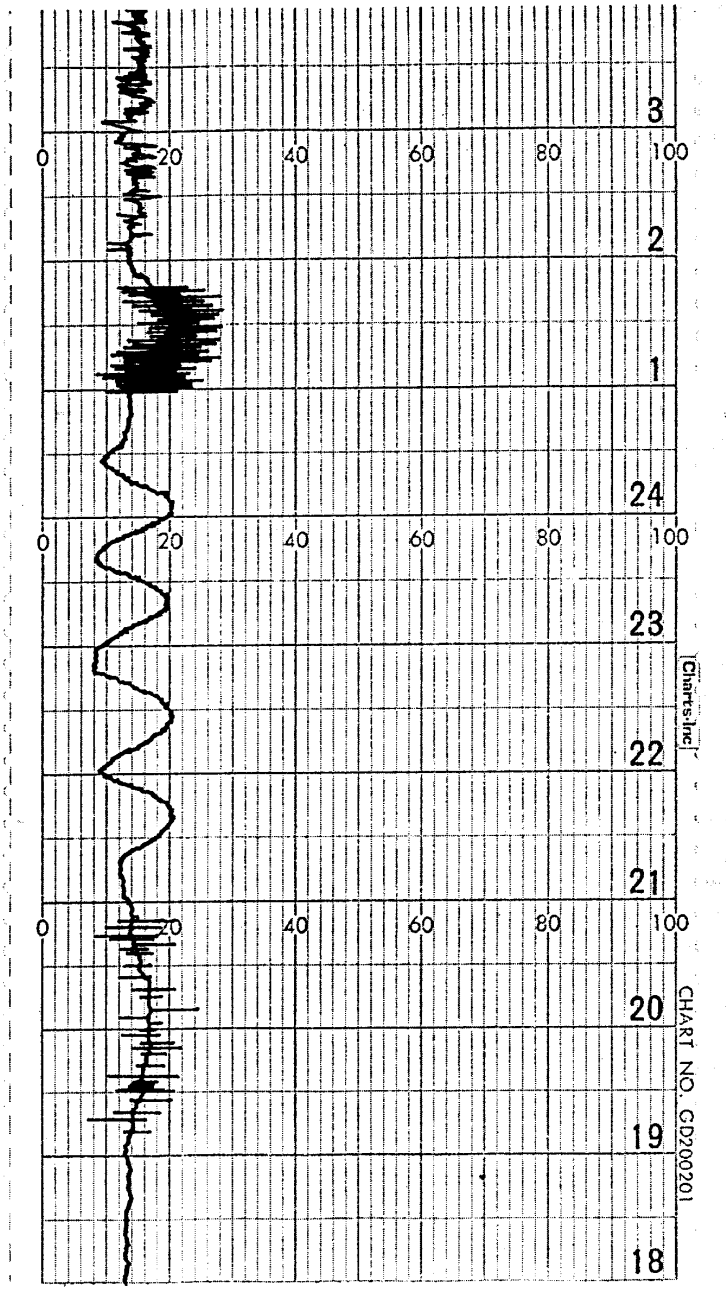

Figure A.2-4. Sample Abnormal Strip Chart Traces.

The strip charts must be clearly annotated to document all power failures and to chart data logger comparisons, station checks, and any event which may lead to data invalidation. Abnormal chart traces, such as those shown in Figure A.2-4, must be reported immediately to the OSC.

A.2.4 Weekly Ozone Zero/Span/Precision Check Forms (ZSP Forms) and Maximum Hourly Average Concentration Verification Forms

A.2.4.1 Weekly Ozone Zero/Span/Precision Check Forms

The results of the automatically activated Zero, Span, and Precision Events and the strip chart recorder's responses to these events are recorded on the Weekly Ozone Zero/Span/Precision Check Form (ZSP Form) by the station operator. The automatic Precision Event is usually performed on Tuesday. The purpose of the ZSP Form is to compare the strip chart values to the data logger values as part of preliminary data validation for that 24-hour period.

Daily Zero and Span Events are automatically activated. Weekly (usually Tuesdays) Precision Events are automatically activated. A review of the following automatic calibration events is performed:

- Zero (Daily)
  Recorded as LEVEL 0 ACTUAL in the CALIBRATION-RESULTS section of the SumX Daily Summary.

- Precision Check (Weekly)
  Recorded as LEVEL 1 ACTUAL in the CALIBRATION-RESULTS section of the SumX Daily Summary.

- Span (Daily)
  Recorded as LEVEL 5 ACTUAL in the CALIBRATION-RESULTS section of the SumX Daily Summary.

  Note: A Daily Summary is a list of the hourly averages obtained from the SumX data logger for all monitored parameters and calibration results, for one 24-hour period.

ACTIVITIES:

The station operator is required to perform the following activities:

1) Complete the ZSP Form (see Figure A.2-5).

   Note: The forms within Sub-section A.2.4 have been completed using data from the example strip charts and Daily Summary found within this SOP.

2) Review the Calibration Summary results for each day and verify the following:

   - O3, CAL AND SO2 LEVEL 0 ACTUAL results are ±0.010 ppm of Zero
   - CAL LEVEL 5 ACTUAL results are between 0.350 and 0.450
   - O3 LEVEL 5 ACTUAL results are ±0.040 of CAL LEVEL 5 ACTUAL
   - SO2 LEVEL 5 ACTUAL results are ±0.040 of the SO2 THEORETICAL LEVEL 5 VALUE

   If you have any questions about determining the acceptability of Precision checks, please refer to Section D or call the OSC.

3) Since it is not practical to make photocopies of all strip charts, it is necessary for the station operator to complete the forms according to the following procedures. These procedures require the operator to compare three data points (Zero, Span, and Precision) for one day each week (usually Tuesdays) between the data logger and the strip chart record. In doing so, the "traceability link" is established between the strip chart and the Daily Summary printed from the data logger.

- On the Daily Summary, locate the calibration results and transcribe the LEVEL 0 ACTUAL, LEVEL 1 ACTUAL, and LEVEL 5 ACTUAL in the corresponding space provided on the ZSP Form.

- Find the automatically activated daily Zero and Span checks which correspond with the weekly Precision check (usually on Tuesdays). Record the last five (5) minute's average chart traces for the Zero, Precision, and Span Event checks on the ZSP Form under the CHART % column (see Figure A.2-5) for the following appropriate event:

  - DAILY ZERO
  - WEEKLY PRECISION CHECK
  - DAILY SPAN

- Calculate the pollutant concentration from the last 5 minutes of the event's chart trace and record the resulting concentration under the CHART PPM column of the ZSP Form. The calculated chart concentration must be within ±0.008 ppm of the data logger averaged concentration.

- If the calculated strip chart concentrations vary from the data logger concentrations by more than ±0.008 ppm, if Span chart traces are irregular and/or out of the prescribed limits, or if abnormal strip chart traces are noted during the review and annotation of the strip charts (see examples in Figure A.2-4), please notify the OSC so the problems may be corrected.

SENDING DOCUMENTATION:

The ZSP Form will be maintained for the duration of the monitoring program with photocopies forwarded to the DPC promptly on a bi-monthly schedule as part of the bi-monthly data packet. The original of each form is maintained at the station.

A.2.4.2 Maximum Hourly Average Concentration Verification Forms

The purpose of the Maximum Hourly Average Concentration Verification Form is to compare the maximum hourly average concentration recorded by the data logger with the maximum hourly average concentration traced by the strip chart recorder for each 24-hour period. The station operator is encouraged to make comments regarding the validity of the data on this form.

ACTIVITIES:

The station operator is required to perform the following activities:

1) Complete the Maximum Hourly Average Concentration Verification Form (see Figures A.2-6, with columns a through e).

1a) Review the SumX Daily Summaries.

- Review all of the daily summaries following the guidelines in the attached "What to Look for on Daily Summaries" guide (see Table A.2-1, page 15 in this section). Document unusual conditions in the station log book and notify the OSC.

- Review each Daily Summary to locate the highest hourly average and hour of occurrence. It may be helpful to underline or highlight the highest hourly average on the daily summaries. If there are several identical hourly averages occurring on the same day, use the first average. DO NOT USE HOURS WITH B, C, or D DATA FLAGS. Other hours with data flags may be used (F, <). Record the highest hourly average (column a of the form) and hour of occurrence (column b of the form) for each day of the monitoring period on the Maximum Hourly Average Concentration Verification Form.

1b) Review and Annotate Strip Charts.

Figure A.2-3b (page 7 of this section) shows an example of how to annotate the maximum hourly average results on the strip chart.

- It is important to remember that the SumX data logger averages data at the end of each hour. For example, data noted as "hour 03:00" was collected between 02:00 and 02:59. On the strip chart, locate and annotate the hour of chart trace that corresponds to the highest hourly average and hour of occurrence for each day recorded on the Maximum Hourly Average Concentration Verification Form.

- Record the average chart trace for that hour on the Maximum Hourly Average Concentration Verification Form (column c of the form) and on the strip chart.

- Calculate the pollutant concentration from the average chart trace (column c of the form) for each day of the monitoring period. The chart to ppm conversion equation to be used is:

$$\frac{\text{chart \% - analyzer Zero value in chart \%}}{200} = \text{concentration in ppm}$$

Record the result on the Maximum Hourly Average Concentration Verification Form (column d of the form) and on the strip chart.

- Verify that the calculated chart concentration for each day is within ±0.008 ppm of the data logger maximum hourly concentration.

- Again, make any appropriate notes about the acceptability of the data in the comments (column e of the form).

SENDING DOCUMENTATION:

The Maximum Hourly Average Concentration Verification Form must be maintained for the duration of the monitoring program with photocopies forwarded to the DPC promptly on a bi-monthly schedule as part of the bi-monthly data packet. The originals of each form are maintained at the station.

WEEKLY ZERO/SPAN/PRECISION CHECK FORM
(ZSP FORM)

STATION:______________________ OPERATOR:________________________

FORMULA USED TO CALCULATE O3 PPM FROM CHART %: ___________________________________

FORMULA USED TO CALCULATE SO2 PPM FROM CHART %: ___________________________________

WEEK: __________ DATE: _________________________

	LEVEL 0 ZERO	CHART %	CHART PPM	LEVEL 1 PRECISION	CHART %	CHART PPM	LEVEL 5 SPAN	CHART %	CHART PPM
SO2									
O3									
CAL									

WEEK: __________ DATE: _________________________

	LEVEL 0 ZERO	CHART %	CHART PPM	LEVEL 1 PRECISION	CHART %	CHART PPM	LEVEL 5 SPAN	CHART %	CHART PPM
SO2									
O3									
CAL									

WEEK: __________ DATE: _________________________

	LEVEL 0 ZERO	CHART %	CHART PPM	LEVEL 1 PRECISION	CHART %	CHART PPM	LEVEL 5 SPAN	CHART %	CHART PPM
SO2									
O3									
CAL									

RANGES OF ACCEPTABLE VALUES			
	LEVEL 0 ZERO	LEVEL 1 PRECISION	LEVEL 5 SPAN
SO2	±0.010 ppm	Between 0.081 and 0.099 ppm	±0.040 ppm
O3	±0.010 ppm	CAL PRECISION ±10%	CAL SPAN ±0.040 ppm
CAL	±0.010 ppm	0.080 to 0.100 ppm	0.350 to 0.450 ppm
Strip Chart (Chart ppm)	O3 ZERO ±0.008 ppm	O3 PRECISION ±0.008 ppm	O3 SPAN ±0.008 ppm

Figure A.2-5. Example Weekly Zero/Span/Precision Check Form (ZSP Form) for Bi-Monthly Mailing.

MAXIMUM HOURLY AVERAGE CONCENTRATION VERIFICATION FORM; DAYS 1-15

PARAMETER: _____ FORMULA USED TO CALCULATE PPM FROM CHART % _____

MONTH/YEAR:_____ STATION:_____

OPERATOR:_____ COMPLETED BY:_____

DATE	MAX SUMX HOUR AVG*		MAX CHART % AVG. (c)	MAX CHART PPM* (d)	COMMENTS CONCERNING DATA VALIDATION (e)
	PPM (a)	HOUR (b)			
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

NOTES: Do **NOT** include hours with flags: B, C, and D.
DO include hours with flags F and <.

* Calculated chart concentration must be within ±0.008 ppm of data logger value.

Figure A.2-6a. Example Maximum Hourly Average Concentration Verification Form; Dates: 1-15.

MAXIMUM HOURLY AVERAGE CONCENTRATION VERIFICATION FORM; DAYS 16-31

PARAMETER: _____ FORMULA USED TO CALCULATE PPM FROM CHART % _____

MONTH/YEAR:_____ STATION:_____

OPERATOR:_____ COMPLETED BY:_____

DATE	MAX SUMX HOUR AVG*		MAX CHART % AVG. (c)	MAX CHART PPM (d)	COMMENTS CONCERNING DATA VALIDATION (e)
	PPM (a)	HOUR (b)			
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

NOTES: Do **NOT** include hours with flags: B, C, and D.
DO include hours with flags F and <.

* Calculated chart concentration must be within ±0.008 ppm of data logger value.

Figure A.2-6b. Example Maximum Hourly Average Concentration Verification Form; Dates: 16-31.

Table A.2-1. What to Look for on Daily Summaries.

O3 VALUES > 0.125 ppm OR < 0.010 ppm - Indicate exceedances of the ozone standard or abnormally low values.
NEGATIVE NUMBERS - Are atypical for ozone, sulfur dioxide, wind speed, wind direction, solar radiation, rainfall.
FLUCTUATING VALUES - Ozone values normally do not change by more than 0.030 ppm from one hour to the next.
CAL SHOULD TRACE @ 0.000 - Except during cal event (except for sites with Dasibi 1009 calibrators).
VWD - Steady values or continuous Zero (0) or Span (360) values are atypical.
VWS - Steady values or continuous Zero (0.0 or Span (25 m/s or 50 mph) are atypical.
SWS - Should always be $\geq$ VWS.
TMP - Steady values or continuous Zero (-50.0) and Span (+50.0) values are atypical.
DPT - Steady values or continuous Zero (-50.0) and Span (+50.0) values are atypical. DPT values should be $\leq$ than TMP. DPT will be closest to TMP when it is very humid.
SOL - Look for diurnal values; low at night and highest during mid-day. Summer maximum values should be > winter values.
RNF - Look for data flags - should be no flags.
STP - This measures shelter temperature, which must be 20-30°C (19.4 to 30.6°C); values should change slowly.
REF - Values should be 1000 ±5. A reading of 635 indicates a ground loop caused by improper wiring. Call OSC for assistance with ground loops.
PWR - This measures the line voltage to the shelter. Typical values are 115 to 125.
SFQ - Dasibi 1003-PC sample frequency. This voltage output x 5 is approximately the frequency display of 40 to 48.
CFQ - Dasibi 1003-PC control frequency. This voltage output x 5 is approximately the frequency display of 20 to 28.
O3L - Lamp voltage from Monitor Labs 8810 ozone monitor. The acceptable range is 1.70 to 1.90. Contact OSC personnel for assistance with lamp adjustments.
CLL - Lamp voltage from Monitor Labs 8810 transfer standard. The acceptable range is 1.70 to 1.90. Contact OSC personnel for assistance with lamp adjustments.
CALIBRATION SUMMARY: O3 LEVEL 0 ACTUAL = ±0.010 FROM ZERO CAL (TRA) LEVEL 0 ACTUAL = ±0.010 FROM ZERO O3 LEVEL 1 ACTUAL within 0.010 ppm of CAL LEVEL 1 ACTUAL. CAL LEVEL 1 ACTUAL - CAL LEVEL 0 ACTUAL = 0.080 TO 0.100. O3 LEVEL 5 ACTUAL = ±0.040 of CAL LEVEL 5 ACTUAL CAL LEVEL 5 ACTUAL = 0.350 to 0.450 SO2 LEVEL 0 ACTUAL = ±0.010 FROM ZERO SO2 LEVEL 1 ACTUAL = ±0.010 OF THEORETICAL VALUE SO2 LEVEL 5 ACTUAL = ±0.040 OF THEORETICAL VALUE

A.2.5 Daily Summaries

Since error-free data transmission cannot be guaranteed through telephone lines, it is essential that the daily summaries be generated by the station operator while they are at the monitoring site.

> Only when instructed to do so by the OSC under unusual circumstances, which include printer failure or when environmental conditions prohibit site access, should data be polled by the station operator via modem communications.

The validation process requires that the polled data be compared to strip charts and to daily summaries generated on-site (see Figure A.2-7, Sample Daily Summary).

ACTIVITIES:

The Daily Summaries are printed by the station operator while he/she performs the procedures outlined in the SumX data logger's Weekly Station Checklist (see Figure B.1.1-1). Although the DPC polls daily summaries from monitoring sites having telephones on a daily basis, and sites without telephones on a weekly basis, the polled data is in raw form and must be validated prior to its release and use. Most modems used in the polling of this data are equipped with error controlling devices which assist in establishing error-free data transmission. These devices are commonly called Error Control Modules (ECMs).

SENDING DOCUMENTATION:

Each original Daily Summary must be kept at the station. Send a legible copy of each Daily Summary in the bi-monthly packet to the DPC.

A.2.6 Weekly Station Checklist

Weekly Station Checklists are completed for each instrument at the monitoring site at least weekly. More frequent checks may be required to document abnormal conditions, such as instrument malfunctions or to assist in the validation of unusually high data events.

> Weekly station checks should not be performed during periods of data collection which exceed National Ambient Air Quality Standards (NAAQS) (0.12 ppm for ozone), but should be postponed and performed immediately after the air pollution episode).

ACTIVITIES:

1) Weekly Station Checklists, along with accompanying detailed procedures for the specific instruments at each station, are included in Section B. When checks of specific station equipment are not within normal/expected ranges, these occurrences should be starred (*) on the checklist and appropriate comments should be added to the station log.

2) While completing the SumX Data Logger Weekly Station Checklist, the following documents will be generated:

   - Daily Summaries
   - Power Failure Logs

3) A station check should be performed each site visit or at a minimum of once per week.

PREVIOUS DAILY SUMMARY 12/10/92 BADLANDS NP

COLUMN NUMBER	01	02	03	04	05	06	07	08
CHANNEL NUMBER	01	02	03	11	09	09	13	15
CHANNEL NAME	SO2	O3	CAL	VWD	VWS	SWS	TMP	DPT
CHANNEL UNITS	PPM	PPM	PPM	DEG	MPH	MPH	DGC	DGC
FULL SCALE VALUE	.490	.479	.980	540	100.0	100.0	50.0	50.0
ZERO VALUE	-.010	-.021	-.020	0	.0	.0	-50.0	-50.0
INPUT RANGE	1	1	1	5	5	5	5	5
INPUT TYPE	S	S	S	D	D	D	D	D
01:00	.001	.051	.000	238	.7	1.0	9.7	5.3
02:00	.001	.055	.000	192	.5	.6	9.0	5.1
03:00	.001	.062	.000	209	.6	.6	9.3	5.0
04:00	.001	.063	.000	213	.9	1.1	9.2	5.0
05:00	.001	.067	.000	251	1.1	1.4	10.2	4.9
06:00	.001	.070	.000	211	.4	.5	10.3	4.8
07:00	.002	.075	.000	274	1.6	1.8	11.5	4.8
08:00	.002F	.070F	.000F	278F	1.9F	2.3F	14.0F	4.9F
09:00	.001<	.072<	.000<	288<	3.9<	4.5<	14.9<	3.6<
10:00	.001D	.065D	.000D	291D	3.0D	3.9D	15.7D	3.7D
11:00	.002B	.230C	.210	333	3.3	4.2	15.2	6.4
12:00	.002	.066	.000	316	3.2	4.4	14.8	7.3
13:00	.002	.068	.000	301	3.9	5.2	15.5	7.9
14:00	.002	.057	.000	288	4.2	5.1	15.3	7.9
15:00	.002	.051	.000	294	3.6	4.5	16.1	7.8
16:00	.001	.065	.000	289	4.3	5.3	15.7	7.8
17:00	.001	.083	.000	294	4.1	5.2	14.9	7.9
18:00	.001	.085	.000	277	4.0	4.6	13.1	8.0
19:00	.001	.107	.000	275	3.4	3.8	12.7	7.9
20:00	.001	.070	.000	259	1.6	1.8	12.1	7.8
21:00	.001	.031	.000	260	.9	1.3	11.3	7.6
22:00	.037B	.066C	.067C	175	.6	.6	9.8	6.7
23:00	.213B	.198C	.201C	174	.6	.6	9.2	6.0
00:00	.005C	.035B	.003B	225	.8	.9	8.7	5.5
AVERAGE	.001<	.021<	.000<	285<	2.0<	2.7<	12.4<	6.2<

COLUMN NUMBER	09	10	11	12	13	14
CHANNEL NUMBER	19	99	05	06	07	08
CHANNEL NAME	SOL	RNF	STP	REF	PWR	O3L
CHANNEL UNITS	WMS	INC	DGC	MVT	VLT	VDC
FULL SCALE VALUE	1500	20.00	100.0	1000	500	5.00
ZERO VALUE	0	.00	.0	0	0	.00
INPUT RANGE	5		1	1	5	5
INPUT TYPE	D		S	S	S	S
01:00	-1	.00	25.2	1000	120	1.80
02:00	-1	.00	24.5	1000	120	1.80
03:00	-1	.00	24.0	1000	120	1.79
04:00	-1	.00	23.6	1000	120	1.78
05:00	-1	.00	23.3	1000	119	1.77
06:00	8	.00	23.1	1000	119	1.76
07:00	90	.00	23.2	1000	119	1.76
08:00	262F	.00F	24.3F	1000F	119F	1.76F
09:00	379<	.00<	25.8<	1000<	119<	1.78<
10:00	502	.00	26.0	1000	119	1.78
11:00	560	.00	25.9	1000	119	1.78
12:00	588	.00	25.4	1000	119	1.77
13:00	725	.00	25.3	1000	119	1.77
14:00	563	.00	25.1	1000	119	1.77
15:00	580	.00	25.1	1000	120	1.77
16:00	478	.00	25.0	1000	120	1.77
17:00	282	.00	25.0	1000	120	1.78
18:00	111	.00	25.4	1000	119	1.78
19:00	27	.00	25.5	1000	119	1.79
20:00	1	.00	25.9	1000	119	1.80
21:00	-1	.00	25.9	1000	119	1.81
22:00	-1	.00	25.8	1000	118	1.81
23:00	-1	.00	26.1	1000	119	1.81
00:00	-1	.00	26.5	1000	119	1.81
AVERAGE	215<	.00<	25.0<	1000<	119<	1.78<

CALIBRATION-RESULTS

COLUMNS # & NAME		LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
01 SO2	ACTUAL	.001C	.084C				.420C
	THEORETICAL	.000	.090				.400
02 O3	ACTUAL	-.001C	.089C				.403C
	THEORETICAL	.000	.090				.400
03 CAL	ACTUAL	.004C	.090C				.408C
	THEORETICAL	.000	.090				.400

Figure A.2-7. Sample Daily Summary.

SENDING DOCUMENTATION:

1) Maintain the original of each Weekly Station Checklist at the station. Mail a copy of the Weekly Station Checklists in the bi-monthly packet to the DPC.

2) In the event that five site visits are scheduled within one month or if a non-scheduled site check is performed, the Weekly Station Checklists have columns for three visits. Two Weekly Station Checklists will be mailed to the DPC per month.

A.2.7 Calibration Forms

A multipoint calibration is performed on a monthly basis with no changes in the sample line configuration. If the calibration is required as a result of Span drift, however, a sample line integrity check (SLIC) will be required.

Please perform SLICs only under the direction of OSC personnel.

If the slope between the calibrator and the ozone analyzer is between 0.90 and 1.10, no SLIC is required.

The sequence of events for performing a multipoint calibration is as follows:

CAL POINT	PPM RANGE
1.	ZERO
2.	high value (concentration range between 0.380 and 0.420 ppm
3.	mid-range value (concentration range between 0.150 and 0.200 ppm)
4.	low range value (concentration range between 0.030 and 0.080 ppm)
5.	ZERO

ACTIVITIES:

1) See Section E for the specific procedures to perform a multipoint calibration.

SENDING DOCUMENTATION:

1) Ozone multipoint calibrations are required monthly. The calibration should be performed on the first Tuesday of each month. Results of all multipoint calibrations are called into the OSC for evaluation and discussion.

2) If a multipoint calibration was performed, the original copy of each form will be maintained at the station. Send a legible photocopy of each form in the bi-monthly packet to the DPC.

A.2.8 Back-up Documentation

Should any of the data being mailed get lost or damaged, our only back-up of the system is with the station operator. Hence, it is important to maintain files of:

- Station Log Book Records
- Power Failure Logs
- Weekly Ozone Zero/Span/Precision Check Forms and Maximum Hourly Average Concentration Verification Forms
- Daily Summaries
- Weekly Station Checklists
- Multipoint Calibration Forms
- Transfer Standard Certification Information (if applicable)
- Performance Audit Data
- Site Systems Audit Data

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**A.3**
Title	**STATION OPERATOR RESPONSIBILITIES (ODESSA VERSION)**
Effective Date	**FEBRUARY 1995**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator	John F. Faust	
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

A.3 STATION OPERATOR RESPONSIBILITIES

Station operators are responsible for sending data packets to the DPC on a bi-monthly basis. The first data packet should contain all documentation corresponding to the data collected from the 1st day of the month through the 15th of the month, and the second data packet should contain all documentation corresponding to the data collected from the 16th day of the month through the end of the month. Both data packets must be sent to the DPC within a week following the end of the completed monitoring data period. These data packets must include all information generated during the monitoring data period and under normal site operations, including:

A.3.1 - The yellow copies of completed station log book pages (the pink copy goes to the OSC)
A.3.2 - Copies of Power Failure Logs
A.3.3 - Reviewed and annotated Strip Charts
A.3.4 - Copies of Weekly Zero/Span/Precision Check Form (ZSP Form), and Maximum Hourly Average Concentration Verification Forms
A.3.5 - Copies of Daily Summaries
A.3.6 - Copies of Weekly Station Checklists
A.3.7 - Copies of Calibration Forms (if applicable)
A.3.8 - Back-up Documentation (if applicable)

NOTE: When the data packet is received by the DPC, a postcard will be sent back to you acknowledging the receipt of the packet.

> If this postcard is not received within 2 weeks of your sending the data packet, notify the DPC before sending any additional data packets.

A.3.1 Station Log Book

The station log book must accurately reflect all site activities, document all telephone conversations with monitoring support personnel, and refer to all documents generated as a result of daily operations.

ACTIVITIES:

1) Document all observations and activities in the station log book. Please note that all entries are to be made in Local Standard Time (LST). See Figure A.3-1, Sample Station Log Book Entry, for an example.

   Useful observations include station log notes regarding the current weather conditions at your site. Helpful observations include:

   - cloud cover (clear, scattered, cumulus, etc.);
   - wind information (northerly winds, calm, windy, etc.);
   - relative temperatures (cold, cool, warm, etc.);
   - humidity (dry, comfortably humid, etc.);
   - precipitation events (rain this morning, snowing at present time, forecast for snow this evening); and/or
   - prescribed burns or wild fires, local road construction, or similar disturbance
   - any comments regarding significant meteorological events since the last station visit (high winds on Thursday, February 4, thunderstorms last night, heavy snowfall last two days, etc.).

Station BADL Page 37
Station Operator J. Smith

National Park Service Air Quality Monitoring Station Log

Date	Time	Action	Station Operator
12/10/92	0540 CST	[ ] Continued from previous page J. Smith in station for weekly station check. Scattered clouds, light winds out of the north, cool.	J Smith
	0545	Changed strip chart paper.	
	0600	Printing daily summaries.	
	0618	Performing station check.	
	0620	Downed 03 & cal.	
	0625	Upped 03 & cal.	
	0634	Downed all met parameters.	
	0655	Upped all met, no adjustments were made.	
	0701	Printed power failure log.	
	0705	Checked sumx & strip chart time, no adjustments were made.	
	0725	Power failure.	
	0809	Power restored after 44 minutes.	
	0910	Reset strip chart time.	
	0915	Called Air Resource Specialists to order sample inlet filters.	
	0948	Downed ozone & cal for filter change.	
	1006	Upped ozone & cal after filter change old filter was unusually dirty. There have been some grass fires in the park that may have contributed to the debris.	
	1025	Started an ozone span to condition filter for 30 minutes.	
	1225	Completed control charts & check lists.	
	1230	J. Smith departing station.	J. Smith
		REST OF PAGE INTENTIONALLY LEFT BLANK.	
		[ ] Continued on following page	

White Copy - to remain in station notebook Yellow Copy - to DPC Pink Copy - to Monitoring Support Contractor

Figure A.3-1. Sample Station Log Book Entry.

These types of observations will help evaluate the overall performance of all air quality and meteorological equipment and provide the NPS with additional confidence in the quality of the reported data.

It is also important to document all site activities in the station log book. This includes all maintenance performed, observations on analyzer/sensor performance, and any other information you feel is important. It is extremely useful to note the times that specific columns (data logger inputs) are "down" (taken off line) during station checks. This will help the DPC to check the overall system performance and to know the validity of the reported values are indeed valid.

Example station log book entry:

Date	Time	Action	Station Operator
11/14/92	*1514* *1524* *1530*	*Columns 4-9 down.* *Columns 4-9 up.* *Tipped precipitation bucket 10 times to check system performance and accuracy.*	*J. Smith*

2) Make certain that both "COPY" pages are legible. Place the stiff piece of cardboard provided along with the log book between the pages so additional copies are not made unintentionally.

3) Make certain that the station name is legible on the original and on the "COPY" pages of the station log book.

4) Note the spaces to check "Continued From Previous/On Following Page" at the upper left and lower right corners of the log book page.

5) If a page has been partially left blank, note on the page "REST OF PAGE INTENTIONALLY LEFT BLANK."

6) Sign the log book each visit (first initial and full last name); this is especially important for stations with multiple operators.

SENDING DOCUMENTATION:

1) The station log books are set-up with 3-part carbonless log book pages. The original page will be maintained at the station. Both "COPY" pages are removed from the station log book and the yellow copy is sent in the bi-monthly packet to the DPC. The pink copy is sent directly to the OSC monthly.

2) Be certain that all station log book entries through the end of the month are included with the second data packet forwarded to the DPC.

A.3.2 Power Failure Logs

The Odessa data logger has the ability to record the ten (10) most recent power failures. This power failure log is necessary to document times and durations of power failures on strip charts (see Figure A.3-2, Sample Odessa Data Logger Power Failure Log). Note that "PLAYBACK" messages are also logged here. "PLAYBACK" indicates the time when the data logger was in "PLAYBACK" mode, such as data logger maintenance periods. Beware that during periods of extensive data logger maintenance (or more than 10 actual power failures), actual "POWER_FL" messages may scroll off.

POWER FAILURES 13:15:12 12/10/92 BADLANDS NP

!	POWER_FL	17:06:40	0033	UNTIL	17:06:45	0033	0812
!	PLAYBACK	14:43:13	0033	UNTIL	14:51:18	0033	07E4
!	PLAYBACK	10:07:11	0033	UNTIL	10:09:21	0033	07D7
!	POWER_FL	10:06:40	0033	UNTIL	10:06:45	0033	0807
!	POWER_FL	11:16:50	0031	UNTIL	11:45:56	0033	0799
!	POWER_FL	23:06:59	0029	UNTIL	23:45:12	0031	0767
!	PLAYBACK	14:43:43	0025	UNTIL	15:05:50	0025	07ED
!	POWER_FL	03:26:46	0020	UNTIL	04:17:19	0020	0756
!	POWER_FL	17:42:10	0009	UNTIL	17:45:13	0009	0723
!	POWER_FL	01:34:12	0002	UNTIL	03:06:31	0002	0701

Figure A.3-2. Sample Odessa Data Logger Power Failure Log.

2ACTIVITIES:

1) The power failure log is printed by the site operator while performing the Weekly Station Checklist.

2) Make absolutely certain that legible copies can be made if necessary.

SENDING DOCUMENTATION:

1) The monitoring station operator has the option of either generating two copies of both the daily summaries and power failure log while performing the weekly station check, or making photocopies of the printouts generated during the site visit. A legible copy must be forwarded to the DPC and the original must be maintained at the monitoring station as a back-up in the event that the bi-monthly data packet is lost, and as material for the station operator's review of the Preliminary Monthly Data Report.

2) The original copy of each power failure log will be kept at the station. Send a legible copy of each power failure log in the bi-monthly packet to the DPC.

A.3.3 Strip Charts

Strip charts are considered to be the primary database for gaseous pollutant monitors since they provide a graphical record of instrument performance. The station operator will need to review and annotate strip charts, noting power failures, abnormal hourly averages, unusual chart traces, etc. Notes should be entered on the chart paper so as to not interfere with any chart data recordings (see Figures A.3-3a and A.3-3b).

ACTIVITIES:

1) Cut and remove the chart paper at 2400 (midnight) on the 15th of the month if you are preparing to send in the first bi-monthly data packet, or at 2400 (midnight) on the last day of the month if you are preparing to send in the second bi-monthly data packet. Make certain that the recorder has enough paper to last until the next scheduled station visit.

2) Annotate the beginning and end of each strip chart with the following (as in Figures A.3-3a and A.3-3b):

   - Operator's first initial and full last name;
   - Station name;
   - Chart Begins: (Date and Local Standard Time);
   - Chart Ends: (Date and Local Standard Time);
   - The equation used to determine ppm concentrations from % chart readings; and
   - If applicable, indicate which colors correspond to what parameters (O3, SO2, etc.) if the strip charts are multi-pen.

3) Annotate the date at the beginning and end of each 24-hour segment of the strip chart (see Figure A.3-3b). The starting time of the daily automatic Zero and Span should provide a good time reference.

4) Review the strip chart trace and identify all power failures listed on the power failure logs on the strip chart (see Figure A.3-2). NOTE ANY POWER FAILURES AND ANY PERIODS WHERE THE ACTUAL TIME DISAGREES WITH THE TIMES PRE-PRINTED ON THE CHART PAPER.

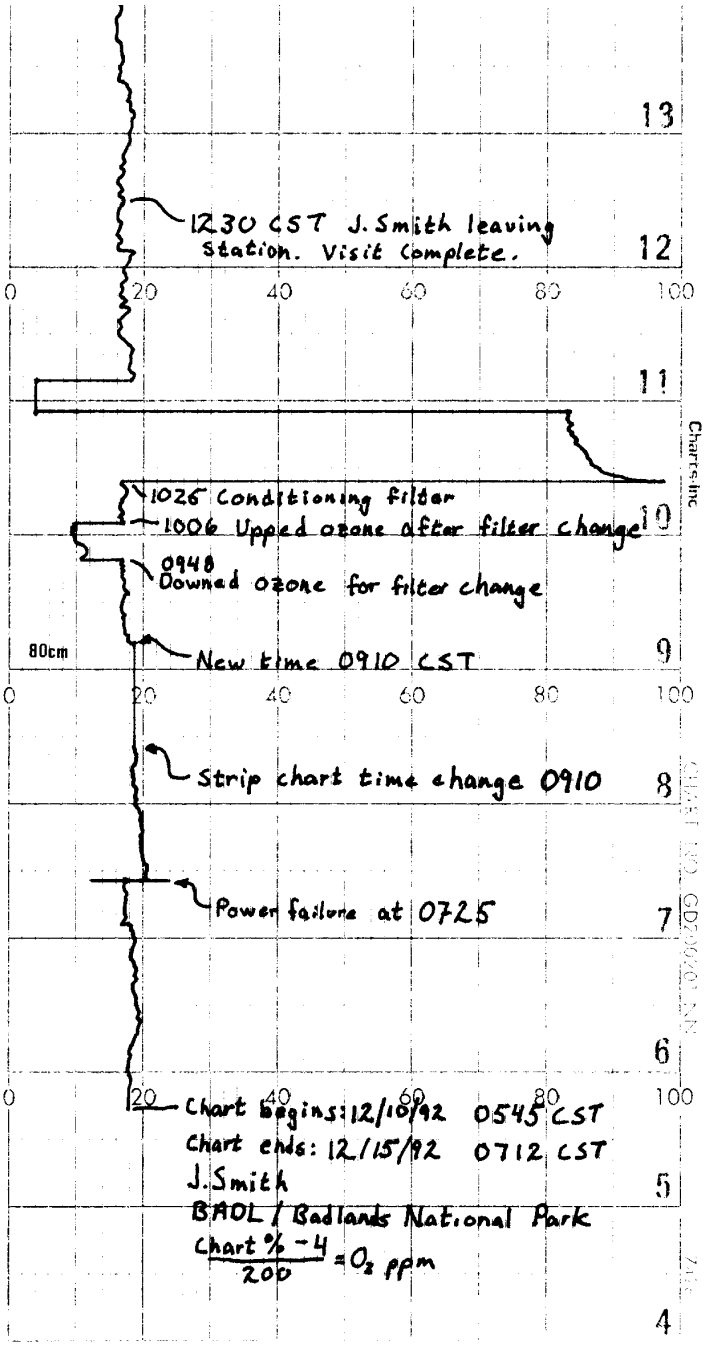

Figure A.3-3a. Sample Annotated Strip Chart Segment.

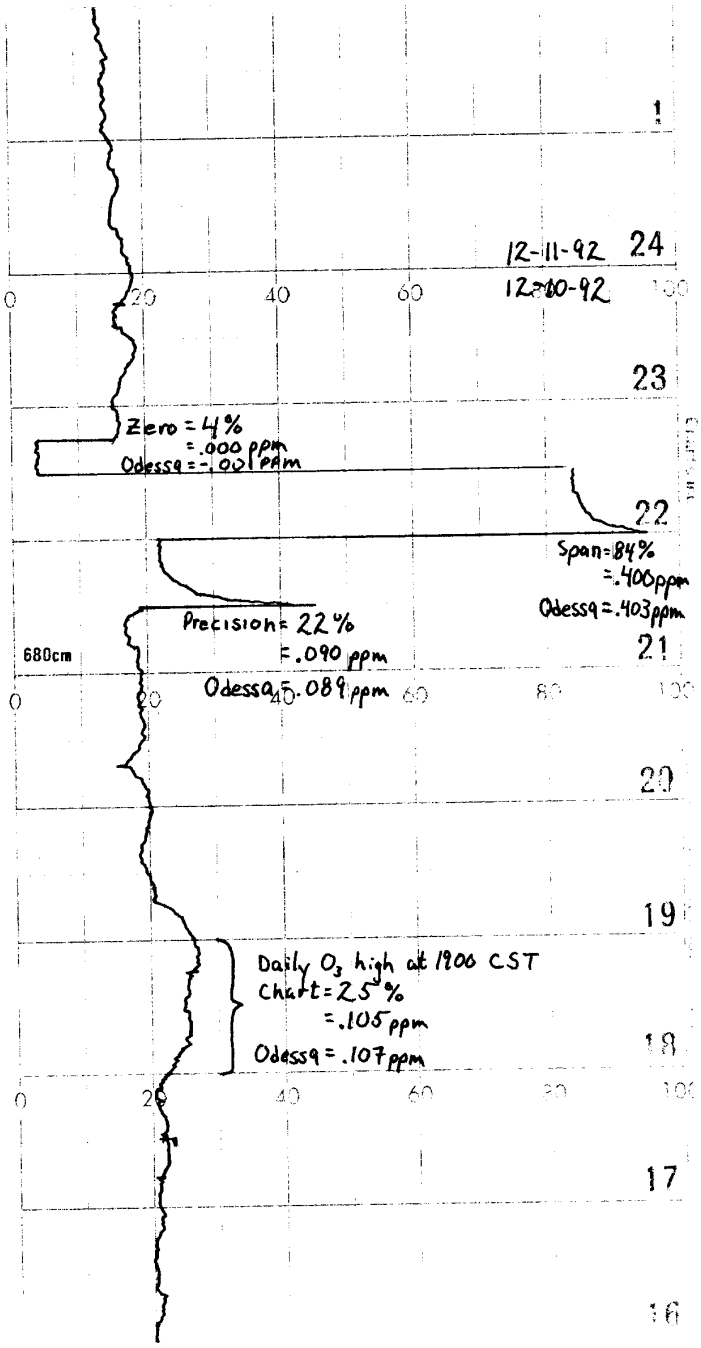

Figure A.3-3b. Sample Annotated Strip Chart Segment.

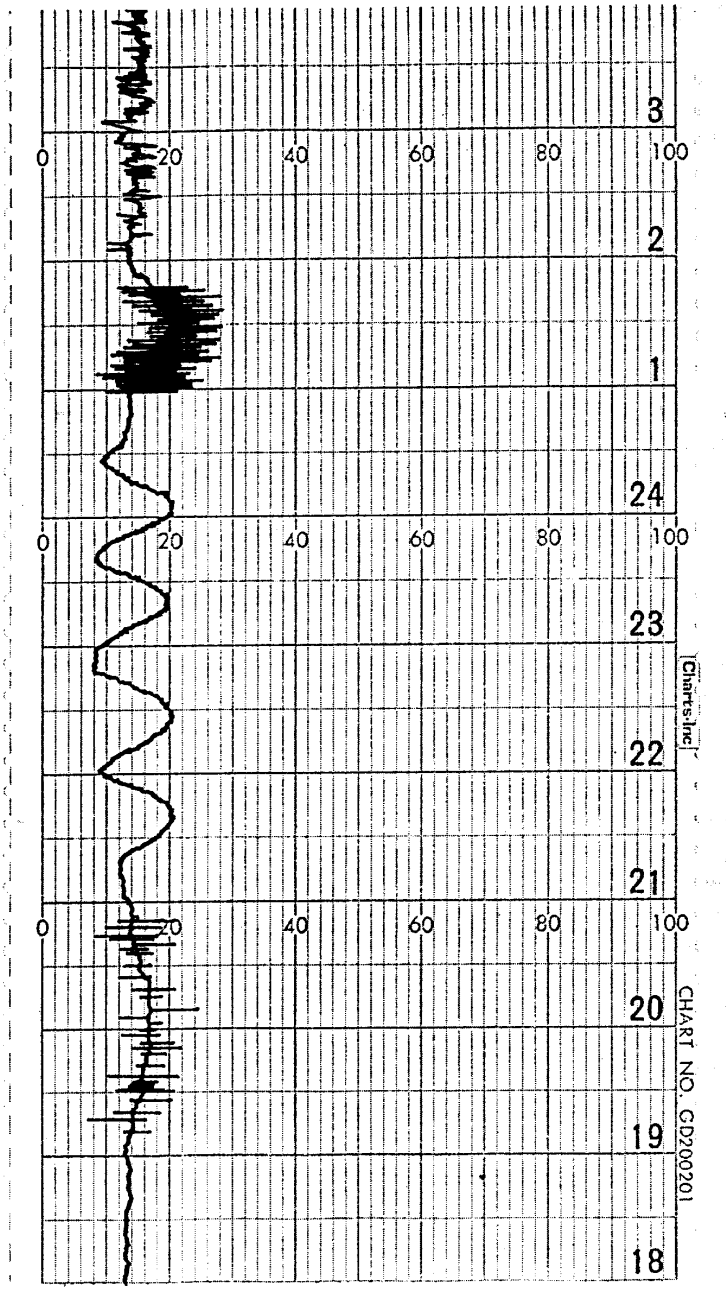

Figure A.3-4. Sample Abnormal Strip Chart Traces.

The strip charts must be clearly annotated to document all power failures and to chart data logger comparisons, station checks, and any event which may lead to data invalidation. Abnormal chart traces, such as those shown in Figure A.3-4, must be reported immediately to the OSC.

A.3.4 Weekly Ozone Zero/Span/Precision Check Forms (ZSP Forms) and Maximum Hourly Average Concentration Verification Forms

Note: The Odessa data logger is programmed to report ozone data in parts per billion (ppb). NPS SOPs and other report documents were developed to report air quality parameters in parts per million (ppm). Where data is reported in ppb, the station operator will need to convert it to ppm by dividing all data values by 1000 before transfer to any data validation or calibration form (i.e., 58 ppb = 0.058 ppm).

A.3.4.1 Weekly Ozone Zero/Span/Precision Check Forms

The results of the automatically activated Zero, Span, and Precision Events and the strip chart recorder's responses to these events are recorded on the Weekly Ozone Zero/Span/Precision Check Form (ZSP Form) by the station operator. The automatic Precision Event is usually performed on Tuesday. The purpose of the ZSP Form is to compare the strip chart values to the data logger values as part of preliminary data validation for that 24-hour period.

Daily Zero and Span Events are automatically activated. Weekly (usually Tuesdays) Precision Events are automatically activated. A review of the following automatic calibration events is performed:

- Zero (Daily)
  Recorded as ZERO/SPAN ZERO ACTUAL (parameter OZONE for analyzer and O3 CAL for calibrator) in the CALIBRATION RESULTS section of the Odessa Daily Summary.

- Precision Check (Weekly)
  Recorded as ZERO/SPAN SPAN1 ACTUAL (parameter OZONE for analyzer and O3 CAL for calibrator) in the CALIBRATION RESULTS section of the Odessa Daily Summary.

- Span (Daily)
  Recorded as ZERO/SPAN SPAN2 ACTUAL (parameter OZONE for analyzer and O3 CAL for calibrator) in the CALIBRATION RESULTS section of the Odessa Daily Summary.

  Note: A Daily Summary is a list of the hourly averages obtained from the Odessa data logger for all monitored parameters and calibration results, for one 24-hour period.

ACTIVITIES:

The station operator is required to perform the following activities:

1) Complete the ZSP Form (see Figure A.3-5).

   Note: The forms within Sub-section A.3.4 have been completed using data from the example strip charts and Daily Summary found within this SOP.

2) Review the Calibration Summary results for each day and verify the following:

   - OZONE, O3 CAL, AND SO2 ZERO ACTUAL results are ±0.010 ppm of 0.000

- O3 CAL SPAN2 ACTUAL results are between 0.350 and 0.450

- OZONE SPAN2 ACTUAL results are ±0.040 of O3 CAL SPAN2 ACTUAL

If you have any questions about determining the acceptability of Precision checks, please refer to Section D or call the OSC.

3) Since it is not practical to make photocopies of all strip charts, it is necessary for the station operator to complete the forms according to the following procedures. These procedures require the operator to compare three data points (Zero, Span, and Precision) for one day each week (usually Mondays) between the data logger and the strip chart record. In doing so, the "traceability link" is established between the strip chart and the Daily Summary printed from the data logger.

   - On the Daily Summary, locate the calibration results for OZONE and O3 CAL and transcribe the ZERO, SPAN1, and SPAN2 ACTUAL values in the corresponding space provided on the ZSP Form.

   - From the strip chart record, find the automatically activated Zero and Span check that corresponds with the weekly Precision check (usually on Mondays). Record the last five (5) minute's average chart traces for the Zero, Precision, and Span Event checks on the ZSP Form under the CHART % column (see Figure A.3-5).

   - Calculate the pollutant concentration using the chart % to ppm formula of the last 5 minutes of the event's chart trace and record the resulting concentration under the CHART PPM column of the ZSP Form. The calculated chart concentration must be within ±0.008 ppm of the data logger averaged concentration.

   - If the calculated strip chart concentrations vary from the data logger concentrations by more than ±0.008 ppm, if Span chart traces are irregular and/or out of the prescribed limits, or if abnormal strip chart traces are noted during the review and annotation of the strip charts (see examples in Figure A.3-4), please notify the OSC so the problems may be corrected.

SENDING DOCUMENTATION:

The ZSP Form will be maintained for the duration of the monitoring program with photocopies forwarded to the DPC promptly on a bi-monthly schedule as part of the bi-monthly data packet. The original of each form is maintained at the station.

A.3.4.2 Maximum Hourly Average Concentration Verification Forms

The purpose of the Maximum Hourly Average Concentration Verification Form is to compare the maximum hourly average concentration recorded by the data logger with the maximum hourly average concentration traced by the strip chart recorder for each 24-hour period. The station operator is encouraged to make comments regarding the validity of the data on this form.

ACTIVITIES:

The station operator is required to perform the following activities:

1) Complete the Maximum Hourly Average Concentration Verification Form (see Figures A.3-6, with columns a through e).

1a) Review the Odessa Daily Summaries.

- Review all of the daily summaries following the guidelines in the attached "What to Look for on Daily Summaries" guide (see Table A.3-1, page 15 in this section). Document unusual conditions in the station log book and notify the OSC.

- Review each Daily Summary to locate the highest hourly average and hour of occurrence. It may be helpful to underline or highlight the highest hourly average on the daily summaries. If there are several identical hourly averages occurring on the same day, use the first average. DO NOT USE HOURS WITH B, C, F, <, or D DATA FLAGS. Record the highest hourly average (column a of the form) and hour of occurrence (column b of the form) for each day of the monitoring period on the Maximum Hourly Average Concentration Verification Form.

1b) Review and Annotate Strip Charts.

Figure A.3-3b (page 7 of this section) shows an example of how to annotate the maximum hourly average results on the strip chart.

- It is important to remember that the Odessa data logger averages data at the end of each hour. For example, data noted as "hour 03:00" was collected between 02:00 and 02:59. On the strip chart, locate and annotate the hour of chart trace that corresponds to the highest hourly average and hour of occurrence for each day recorded on the Maximum Hourly Average Concentration Verification Form.

- Record the average chart trace for that hour on the Maximum Hourly Average Concentration Verification Form (column c of the form) and on the strip chart.

- Calculate the pollutant concentration from the average chart trace (column c of the form) for each day of the monitoring period. The chart to ppm conversion equation to be used is:

$$\frac{\text{chart \% - analyzer Zero value in chart \%}}{200} = \text{concentration in ppm}$$

Record the result on the Maximum Hourly Average Concentration Verification Form (column d of the form) and on the strip chart.

- Verify that the calculated chart concentration for each day is within ±0.008 ppm of the data logger maximum hourly concentration.

- Again, make any appropriate notes about the acceptability of the data in the comments (column e of the form).

SENDING DOCUMENTATION:

The Maximum Hourly Average Concentration Verification Form must be maintained for the duration of the monitoring program with photocopies forwarded to the DPC promptly on a bi-monthly schedule as part of the bi-monthly data packet. The originals of each form are maintained at the station.

WEEKLY ZERO/SPAN/PRECISION CHECK FORM
(ZSP FORM)

STATION:_____ OPERATOR:_____

FORMULA USED TO CALCULATE O3 PPM FROM CHART %: _____

FORMULA USED TO CALCULATE SO2 PPM FROM CHART %:_____

WEEK: _____ DATE: _____

	ZERO	CHART %	CHART PPM	SPAN1 (PRECISION)	CHART %	CHART PPM	SPAN2	CHART %	CHART PPM
SO2									
OZONE									
O3 CAL									

WEEK: _____ DATE: _____

	ZERO	CHART %	CHART PPM	SPAN1 (PRECISION)	CHART %	CHART PPM	SPAN2	CHART %	CHART PPM
SO2									
OZONE									
O3 CAL									

WEEK: _____ DATE: _____

	ZERO	CHART %	CHART PPM	SPAN1	CHART %	CHART PPM	SPAN2	CHART %	CHART PPM
SO2									
O3									
CAL									

RANGES OF ACCEPTABLE VALUES			
	ZERO	SPAN1	SPAN2
SO2	±0.010 ppm	Between 0.081 and 0.099 ppm	±0.040 ppm
OZONE	±0.010 ppm	CAL PRECISION ±10%	CAL SPAN ±0.040 ppm
O3 CAL	±0.010 ppm	0.080 to 0.100 ppm	0.350 to 0.450 ppm
Strip Chart (Chart ppm)	O3 ZERO ±0.008 ppm	O3 PRECISION ±0.008 ppm	O3 SPAN ±0.008 ppm

Figure A.3-5. Example Weekly Zero/Span/Precision Check Form (ZSP Form) for Bi-Monthly Mailing.

MAXIMUM HOURLY AVERAGE CONCENTRATION VERIFICATION FORM; DAYS 1-15

PARAMETER: _____ FORMULA USED TO CALCULATE PPM FROM CHART % _____

MONTH/YEAR:_____ STATION:_____

OPERATOR:_____ COMPLETED BY:_____

DATE	MAX ODESSA HOUR AVG*		CORRESPONDING HOUR CHART % AVG. (c)	CHART PPM* (d)	COMMENTS CONCERNING DATA VALIDATION (e)
	PPM# (a)	HOUR (b)			
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

NOTES: Do **NOT** include hours with flags: B, C, D, F, and <.

* Calculated chart concentration must be within ±0.008 ppm of data logger value.

\# PPB ÷ 1000 = PPM

Figure A.3-6a. Example Maximum Hourly Average Concentration Verification Form; Dates: 1-15.

MAXIMUM HOURLY AVERAGE CONCENTRATION VERIFICATION FORM; DAYS 16-31

PARAMETER: _____ FORMULA USED TO CALCULATE PPM FROM CHART % _____

MONTH/YEAR:_____ STATION:_____

OPERATOR:_____ COMPLETED BY:_____

DATE	MAX ODESSA HOUR AVG*		CORRESPONDING HOUR CHART % AVG. (c)	CHART PPM* (d)	COMMENTS CONCERNING DATA VALIDATION (e)
	PPM# (a)	HOUR (b)			
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

NOTES: Do **NOT** include hours with flags: B, C, D, F, and <.

* Calculated chart concentration must be within ±0.008 ppm of data logger value.

\# PPB ÷ 1000 = PPM

Figure A.3-6b. Example Maximum Hourly Average Concentration Verification Form; Dates: 16-31.

Table A.3-1. What to Look for on Daily Summaries.

OZONE VALUES > 0.125 ppm OR < 0.010 ppm - Indicate exceedances of the ozone standard or abnormally low values.
NEGATIVE NUMBERS - Are atypical for ozone, sulfur dioxide, wind speed, wind direction, solar radiation, rainfall.
FLUCTUATING VALUES - Ozone values normally do not change by more than 0.030 ppm from one hour to the next.
WDR - Steady values or continuous Zero (0) or Span (360) values are atypical.
WSP - Steady values or continuous Zero (0.0 or Span (25 m/s or 50 mph) are atypical.
SCAWS - Should always be $\geq$ VWS.
TEMP - Steady values or continuous Zero (-50.0) and Span (+50.0) values are atypical.
SOL RAD - Look for diurnal values; low at night and highest during mid-day. Summer maximum values should be > winter values.
RAIN - Look for data flags - should be no flags.
STP - This measures shelter temperature, which must be 20-30°C (19.4 to 30.6°C); values should change slowly.
CALIBRATION SUMMARY: OZONE ZERO ACTUAL = ±0.010 FROM ZERO O3 CAL ZERO ACTUAL = ±0.010 FROM ZERO OZONE SPAN1 ACTUAL within 0.010 ppm of CAL LEVEL 1 ACTUAL. O3 CAL SPAN1 ACTUAL = O3 CAL ZERO ACTUAL = 0.080 TO 0.100. OZONE SPAN2 ACTUAL = ±0.040 of O3 CAL SPAN2 ACTUAL O3 CAL SPAN2 ACTUAL = 0.350 to 0.450 SO2 ZERO ACTUAL = ±0.010 FROM ZERO SO2 SPAN1 ACTUAL = ±0.010 OF EXPECTED VALUE SO2 SPAN2 ACTUAL = ±0.040 OF EXPECTED VALUE

A.3.5 Daily Summaries

Since error-free data transmission cannot be guaranteed through telephone lines, it is essential that the daily summaries be generated by the station operator while they are at the monitoring site.

> Only when instructed to do so by the OSC under unusual circumstances, which include printer failure or when environmental conditions prohibit site access, should data be polled by the station operator via modem communications.

The validation process requires that the polled data be compared to strip charts and to daily summaries generated on-site (see Figure A.3-7, Sample Daily Summary).

ACTIVITIES:

The Daily Summaries are printed by the station operator while he/she performs the procedures outlined in the Odessa data logger's Weekly Station Checklist (see Figure B.1.1-1). Although the DPC polls daily summaries from monitoring sites having telephones on a daily basis, and sites without telephones on a weekly basis, the polled data is in raw form and must be validated prior to its release and use. Most modems used in the polling of this data are equipped with error controlling devices which assist in establishing error-free data transmission. These devices are commonly called Error Control Modules (ECMs).

SENDING DOCUMENTATION:

Each original Daily Summary must be kept at the station. Send a legible copy of each Daily Summary in the bi-monthly packet to the DPC.

A.3.6 Weekly Station Checklist

Weekly Station Checklists are completed for each instrument at the monitoring site at least weekly. More frequent checks may be required to document abnormal conditions, such as instrument malfunctions or to assist in the validation of unusually high data events.

> Weekly station checks should not be performed during periods of data collection which exceed National Ambient Air Quality Standards (NAAQS) (0.12 ppm for ozone), but should be postponed and performed immediately after the air pollution episode).

ACTIVITIES:

1) Weekly Station Checklists, along with accompanying detailed procedures for the specific instruments at each station, are included in Section B. When checks of specific station equipment are not within normal/expected ranges, these occurrences should be starred (*) on the checklist and appropriate comments should be added to the station log.

2) While completing the Odessa Data Logger Weekly Station Checklist, the following documents will be generated:

   - Daily Summaries
   - Power Failure Logs

3) A station check should be performed each site visit or at a minimum of once per week.

10:00:33 0345 01 BNP 168 12/10/92

	01	02	03	04	05	06	07	08	
CHAN	RAIN	WDR	WSP	TEMP	DELTMP	RELHUM	OZONE	O3 CAL	SD1
UNITS	INCHES	DEG	M/S	DEG C	DEG C	%	PPB	PPB	DEG
FSCL	10.00	360	50.0	50.0	7.00	100.0	500	1000	99.9
ZERO	0.00	0	0.0	-50.0	-3.00	0.0	0	0	00.0
01:00	0.00	240	0.3	-5.9	0.62	89.0	51	00	52.2
02:00	0.00	201	0.3	-6.4	0.69	90.3	55	00	54.2
03:00	0.00	152	0.3	-6.6	0.67	90.0	62	00	52.5
04:00	0.00	227	0.3	-7.0	0.67	91.1	63	00	67.0
05:00	0.00	202	0.3	-6.6	0.58	91.1	67	00	52.0
06:00	0.00	188	0.4	-6.7	0.50	91.1	70	00	51.8
07:00	0.00	97	0.2	-6.0	0.48	90.1	75	00	67.0
08:00	0.00F	209F	0.3F	-6.1F	0.57F	90.1F	70F	00F	49.4
09:00	0.00	41	0.2	-5.6	0.60	86.0	70	00	53.3
10:00	0.00	210	0.5	-4.8	0.60	87.0	72<	00	25.9
11:00	0.00	201	1.0	-2.1	0.34	77.0	65D	00	19.9
12:00	0.00	243	0.9	0.5	0.41	62.2	66	00	22.5
13:00	0.00	268	0.6	2.1	0.39	57.5	66	00	39.6
14:00	0.00	31	1.1	2.7	0.14	55.9	68	00	34.5
15:00	0.00	04	1.1	3.1	0.17	55.1	57	00	45.9
16:00	0.00	343	1.0	3.6	0.21	56.3	51	00	51.3
17:00	0.00	53	0.8	3.5	0.53	55.2	65	00	45.2
18:00	0.00	48	0.6	3.1	0.99	55.2	83	00	41.4
19:00	0.00	07	1.2	2.2	0.36	63.9	85	00	43.2
20:00	0.00	14	1.3	-0.2	0.07	82.9	107	00	48.9
21:00	0.00	347	1.1	-0.6	0.12	79.2	70	00	54.4
22:00	0.00	05	0.9	-1.3	0.11	85.0	31C	00<	57.4
23:00	0.00	23	0.6	-1.5	0.08	79.7	30C	00C	64.5
24:00	0.01	10	1.2	-2.1	0.06	88.7	35	00	50.9
SUMMA	0.01	------	0.7<	-2.1<	0.41<	77.2<	64<	00<	

	09	10	11	12	13
CHAN	SOLRAD	FLOW	SCAWS	WETNES	STP
UNITS	W/M2	LPM	M/S	ON/OFF	DGC
FSCL	1396	9.04	50.0	1.00	100.0
ZERO	0	0.21	0.0	0.00	.0
01:00	01	2.99	0.4	0.01	21.9
02:00	01	2.99	0.5	0.01	21.7
03:00	01	2.99	0.5	0.01	21.7
04:00	01	2.99	0.5	0.01	21.7
05:00	01	2.99	0.7	0.01	21.7
06:00	01	2.99	0.6	0.01	21.8
07:00	01	2.99	0.8	0.01	21.8
08:00	01F	2.99F	1.0F	0.01F	21.5F
09:00	23	2.99	0.6	0.01	21.6
10:00	42	2.99	0.6	0.01	21.7
11:00	272	2.99	1.0	0.01	21.8
12:00	383	2.99	0.9	0.01	22.6
13:00	388	2.99	1.0	0.21	23.5
14:00	199	2.99	1.3	0.01<	24.6
15:00	168	2.99	1.5	0.01	24.7
16:00	78	2.99	1.4	0.01	23.7
17:00	37	2.99	1.0	0.01	23.5
18:00	07	2.99	1.0	0.01	23.3
19:00	01	2.99	1.6	0.01	22.9
20:00	01	2.99	1.7	0.01	22.7
21:00	01	2.99	1.8	0.01	22.1
22:00	01	2.99	1.5	0.01	22.1
23:00	00	2.99	1.3	0.01	22.1
24:00	01	2.99	1.5	0.01	22.2
SUMMA	67<	2.99<	1.0<	0.02<	22.4<

CALIBRATION RESULTS

ZERO/SPAN	PARAMETER	START	STOP	DAY	ACTUAL	EXPECTED	TYPE
ZERO	07 OZONE	22:30	22:45	0040	-01	00	I
SPAN1	07 OZONE	21:30	22:00	0040	89	90	I
SPAN2	07 OZONE	22:00	22:30	0040	403	400	I
ZERO	08 O3 CAL	22:30	22:45	0040	04	00	I
SPAN1	08 O3 CAL	22:00	22:30	0040	90	90	I
SPAN2	08 O3 CAL	22:00	22:30	0040	408	400	I

Figure A.3-7. Sample Daily Summary.

SENDING DOCUMENTATION:

1) Maintain the original of each Weekly Station Checklist at the station. Mail a copy of the Weekly Station Checklists in the bi-monthly packet to the DPC.

2) In the event that five site visits are scheduled within one month or if a non-scheduled site check is performed, the Weekly Station Checklists have columns for three visits. Two Weekly Station Checklists will be mailed to the DPC per month.

A.3.7 Calibration Forms

A multipoint calibration is performed on a monthly basis with no changes in the sample line configuration. If the calibration is required as a result of Span drift, however, a sample line integrity check (SLIC) will be required.

Please perform SLICs only under the direction of OSC personnel.

If the slope between the calibrator and the ozone analyzer is between 0.90 and 1.10, no SLIC is required.

The sequence of events for performing a multipoint calibration is as follows:

CAL POINT	PPM RANGE
1.	ZERO
2.	high value (concentration range between 0.380 and 0.420 ppm
3.	mid-range value (concentration range between 0.150 and 0.200 ppm)
4.	low range value (concentration range between 0.030 and 0.080 ppm)
5.	ZERO

ACTIVITIES:

1) See Section E for the specific procedures to perform a multipoint calibration.

SENDING DOCUMENTATION:

1) Ozone multipoint calibrations are required monthly. The calibration should be performed on the first Tuesday of each month. Results of all multipoint calibrations are called into the OSC for evaluation and discussion.

2) If a multipoint calibration was performed, the original copy of each form will be maintained at the station. Send a legible photocopy of each form in the bi-monthly packet to the DPC.

A.3.8 Back-up Documentation

Should any of the data being mailed get lost or damaged, our only back-up of the system is with the station operator. Hence, it is important to maintain files of:

- Station Log Book Records
- Power Failure Logs
- Weekly Ozone Zero/Span/Precision Check Forms and Maximum Hourly Average Concentration Verification Forms
- Daily Summaries
- Weekly Station Checklists
- Multipoint Calibration Forms
- Transfer Standard Certification Information (if applicable)
- Performance Audit Data
- Site Systems Audit Data

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**B**
Title	**MONITORING EQUIPMENT PROCEDURES AND TECHNICAL INSTRUCTIONS**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

SECTION B MONITORING EQUIPMENT PROCEDURES AND TECHNICAL INSTRUCTIONS

Completed checklists assist the Data Processing Center (DPC) in determining if the instruments at the station are operating within acceptable performance limits. Although a great deal of information is accessible by polling the site and communicating with the data logger, the station checklist documents operating parameters, such as rotameter ball settings, which cannot be monitored by the data loggers. Review of the station checklists enables the DPC to make decisions whether to validate or to invalidate data. The Monitoring Operations Support Contractor (OSC) uses the information to decide when to schedule station calibration and maintenance visits. The information also aids in diagnosing problems as they develop and minimizing instrument down-time and data loss.

It is the station operator's responsibility to complete the checklists for each instrument at the monitoring station during the weekly station visit.

Section B includes the following sub-sections:

- Section B.1 - Data Loggers
- Section B.2 - Station Calibrators
- Section B.3 - Ozone Analyzers
- Section B.4 - Continuous Sulfur Dioxide Analyzers
- Section B.5 - Meteorological Systems
- Section B.6 - Strip Chart Records, Printers, Modems and Miscellaneous Equipment

The weekly station checklists are a condensed form of the written procedures for station operations documentation. Experienced station operators will probably be able to complete the checklists without referring to the written procedures included in this section. These procedures may be used to clarify any problems incurred during completion of the checklist or may be used as a step-by-step guide for new and/or substitute station operators. As always, please feel free to call monitoring support personnel whenever any problems or questions develop at the station. A list of contacts is included in the Introduction section (see Figure INTRO-3).

NATIONAL PARK SERVICE
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STANDARD OPERATING PROCEDURES

Section	**B.1**
Title	**DATA LOGGERS**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.1 DATA LOGGERS

Data loggers perform many essential functions for the ambient air quality station and perform numerous tasks beyond simply "logging" or recording raw data. Modern data loggers, along with necessary peripherals, such as keyboards/monitors and modems, are often referred to as "Data Acquisition Systems." The data logger provides the interface between the human operator and the electronic sensing equipment.

The data logger performs the following duties:

- Measures the analog (and digital) outputs of sensors or an analyzer.
- Converts measured values into "engineering units", i.e., parts per million (ppm) or meters per second (m/s).
- Computes user-defined averages (typically 5 minute and hourly) and stores these averages for subsequent retrieval.
- Automatically annotates recorded values with status flags to indicate the condition of a recorded value, such as an instrument under calibration, temperature out-of-range, or others.
- Monitors recorded values for out-of-range conditions and activates an alarm or other signal if desired.
- Tracks and logs internal functions, such as power failures, operator entered messages, digital errors, and others.
- Provides digital outputs to calibrators or other peripheral devices to control functions, such as automatic calibrations, on a pre-programmed basis.

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**B.1.3**
Title	**ODESSA DSM 3260 DATA LOGGER**
Effective Date	**MARCH 1996**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator	John F. Faust	
NPS COTR	John D. Ray	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.1.3 Odessa DSM 3260 Data Logger

PROCEDURES

B.1.3.1 Sign-in in the NPS Ozone station log book. Have a set of Weekly Station Checklist sheets ready (see Figure B_3_1-1). Up to three station checks may be recorded on one station checklist. Record the time, and summarize the weather conditions for the past week in the station log book. Record your first initial and last name, the Odessa serial number, and the calendar date on the weekly station checklist.

Turn on the keyboard (the switch is near the back on the right side). The keyboard will print various messages on the screen, and then will ask for the "current time" and the "current date." Our operations do not require the correct terminal time, so you may bypass the question by pressing <Enter>. The keyboard will display a "welcoming screen." Press F1 to start up, and press CAPS LOCK.

B.1.3.2 Record the time from the data logger display on the station checklist. Do the following procedure:

KEYBOARD DISPLAY	OPERATOR KEY-IN
	T

TIME IS HH:MM:SS JDAY SITE NAME MM/DD/YY

The Odessa time, Julian date, site name, and month/day/year in the above format will be displayed. Datalogger time should be within five minutes of the correct local standard time. Verify the correct time by calling 303-499-711 (Coordinated Universal Time) or by another authoritative standard. If the data logger time needs adjustment, the data logger must first be put into "Playback" mode. Proceed as follows:

KEYBOARD DISPLAY	OPERATOR KEY-IN
	@N
*	>HHMMSSJDAY <ENTER>
Y	@

where HHMMSSJDAY are the correct hour, minute, seconds, and Julian date (4 characters are necessary, i.e., 0365). The data logger will respond with a "Y" if the entered format is correct. The data logger will return to "Data Collection" mode after entering the @ symbol (and no other characters) or if the system does not receive any characters after 3 minutes. Verify the time and date are correct, and indicate that a data logger time change was necessary on the station checklist and also record the data logger time corrections in the station logbook.

B.1.3.3 Print a power failure log. To print any data or information from the Odessa, simply turn the printer power "ON." This will direct all keystrokes and data logger responses to both the terminal display and the printer. To print this log, type "F." Included with recent power failures, the Odessa logs the times the data logger was in "Playback" mode. The ten most recent occurrences of these conditions will be printed.

STATION: _____
WEEKLY STATION CHECKLIST
SECTION B.1.3 ODESSA DSM 3260 DATA LOGGERS

RECORD THE FOLLOWING:		VISIT 1		VISIT 2		VISIT 3	
B.1.3.1	SITE OPERATOR						
	ODESSA SERIAL NUMBER						
	CALENDAR DATE						
B.1.3.2	UNADJUSTED ODESSA TIME (IF DIFFERENCE IS GREATER THAN 5 MINUTES, NOTIFY THE OSC.)						
	LOCAL STANDARD TIME						
	ODESSA TIME ADJUSTED? (Y/N)						
B.1.3.3	POWER FAILURE LOG GENERATED?						
B.1.3.4	DAILY SUMMARIES GENERATED? (NOTE DATES IN SITE LOG BOOK)						
B.1.3.5	STP 20 TO 30°C ON DAILY SUMMARIES? (Y/N)						
	THERMOSTAT ADJUSTMENT MADE? (Y/N)						
B.1.3.6	CURRENT SHELTER TEMP (ODESSA STP)						
	CURRENT THERMOMETER READING						
	DIFFERENCE (< 1.5°C)						
B.1.3.7	DAILY SUMMARIES REVIEWED? (Y/N)						
B.1.3.8	MOST RECENT OZONE AND OZONE CAL ZERO ACTUAL VALUES. (BOTH VALUES SHOULD BE ±10 PPB.)*	O3	CAL	O3	CAL	O3	CAL
B.1.3.9	MOST RECENT OZONE AND OZONE CAL SPAN 1 (PRECISION) ACTUAL VALUES. (OZONE CAL SPAN 1 VALUE SHOULD BE BETWEEN 80 AND 100 PPB, AND OZONE SPAN 1 ACTUAL SHOULD BE ±10% OF OZONE CAL SPAN 1 ACTUAL.*)	O3	CAL	O3	CAL	O3	CAL
B.1.3.10	MOST RECENT OZONE AND OZONE CAL SPAN 2 (SPAN) ACTUAL VALUES. (OZONE CAL SPAN 2 VALUE SHOULD BE BETWEEN 350 AND 450 PPB, AND O3 CAL SPAN 2 ACTUAL VALUE SHOULD BE ±40 PPB OF THE CAL VALUE.)*	O3	CAL	O3	CAL	O3	CAL

* If values are not within acceptable ranges, notify the OSC.

Figure B.1.3-1. Sample Odessa 3260 Data Logger Weekly Station Checklist.

B.1.3.4 Print Daily Summaries. The daily summaries from the previous week are printed each Tuesday. Advance the printer paper to the top of the page, turn on the printer, make sure it is on-line, and begin printing the daily summaries by entering the number of days previous for the first summary you want to print. For example, for last Tuesday's summary, press 7 (for 7 days ago). Repeat for each day until the summaries for the past week are printed.

Once the daily summaries and power failure log are printed, deactivate (take off-line) the printer. Record the dates of the printed summaries in the log book and check off on the checklist.

NOTE: A copy of each daily summary must be sent to the DPC and a copy must remain at the monitoring station. The site operator has the option of either generating two copies of each daily summary and power failure on-site, or photocopying the originals and retaining the copy for the monitoring site files. Please make certain that all copies are completely readable.

B.1.3.5 Scan the shelter temperature (STP) column on the daily summaries and verify that the station temperature remained between 20 and 30 degrees. EPA instrument equivalency designation requires gaseous pollutant analyzers (SO2 and O3) to be operated within this range and data collected when STPs were out of this range must be invalidated.

If the shelter temperature has fallen outside the required range, note in the log book that the corresponding data must be invalidated and make the appropriate thermostatic adjustments.

B.1.3.6 Check the current shelter temperature by performing the following:

KEYBOARD DISPLAY	OPERATOR KEY-IN
	U
HH:MM .01 225 4.1 17.5 -2.48 37.9 48 00	
HH:MM 495 2.97 4.7 0.01 **25.4**	

The current shelter temperature will appear in the 13th data record (shown in bold above). Record the current shelter temperature on the station checklist. Record the value of the shelter mercury thermometer. The shelter mercury thermometer should be located near the quality assurance monitor (QAM) where the STP value is measured. Subtract the two values and record the difference on the station checklist. If the difference is greater than 1.5°, call the OSC for assistance.

B.1.3.7 Review the daily summaries that you just printed. Report any unusual hourly averages to the OSC. For a list of "What to look for on Daily Summaries", see Section A-2, page 15.

B.1.3.8 Review the "CALIBRATION RESULTS" section of the daily summaries that were just generated (see Figure B.1.3-2). Verify that the most recent ZERO/OZONE/ACTUAL and ZERO/O3 CAL/ACTUAL were between -10 and 10 ppb. If not, call the OSC. Record these values on the Weekly Station Checklist.

B.1.3.9 Determine when the most recent precision check was performed (previous Tuesday) and review the CALIBRATION RESULTS for that day. Verify the SPAN1/OZONE/ACTUAL was between 80 and 100 ppb and the SPAN1/O3 CAL/ACTUAL was within 10% of that value. If not, call the OSC. Record these values on the Weekly Station Checklist.

B.1.3.10 Verify the most recent SPAN2/OZONE/ACTUAL and SPAN2/O3 CAL/ACTUAL are between 350 and 450 ppb and the O3/ACTUAL is within 10% of the O3 CAL/ACTUAL. If not, call the OSC. Record these values on the Weekly Station Checklist.

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**B.2**
Title	**STATION CALIBRATORS**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.2 STATION CALIBRATORS

All measuring devices need to be referenced to an authoritative standard. This provides the end user confidence that the recorded values were measured accurately and that other comparative data sets are also collected with similar accuracy.

Station calibrators are capable of consistently reproducing calculated or measured amounts of the substance to be measured and presenting that quantity (known ppm of ozone) to the measuring device (analyzer).

Station calibrators for ozone consist of a zero air supply, an ozone generator, and an ozone photometer (analyzer). In standard practice, the station calibrator stands by, inactive, but in a ready mode, waiting for a command from the data logger to output zero air or a known concentration of ozone. These commands may be pre-programmed or timed, or they may be the result of an operator-initiated command.

All ozone calibrators in the NPS network have been modified to output two adjustable concentrations of ozone. The "Span" refers to a concentration between 0.350 and 0.450 ppm. The "Precision" refers to a concentration between 0.080 and 0.100 ppm. Other concentrations may be obtained by making a mechanical thumbwheel adjustment to the ozone generator control.

NATIONAL PARK SERVICE
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STANDARD OPERATING PROCEDURES

Section	**B.2.1**
Title	**DASIBI 1003-PC OZONE CALIBRATOR/TRANSFER STANDARD**
Effective Date	**JUNE 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.2.1 Dasibi 1003-PC Ozone Calibrator/Transfer Standard

PROCEDURES

B.2.1.1 Record the station name, operator name (first initial and full last name), the instrument serial number, NPS property tag number, and calendar date on the Weekly Station Checklist (see Figure B.2.1-1).

B.2.1.2 Verify that the power is on, the sample and calibrator pumps are off, the ozone generator lamp is off, the "AUTO/MANUAL" switch is in the "AUTO" position, and the function switch is in "Operate."

B.2.1.3 Verify that the "MAN O3 ADJ" thumbwheel setting is in the SPAN setting and the "AUTO O3 ADJ" thumbwheel setting is in the PRECISION setting. Check the previous week's settings to verify that they have not been changed. Record the settings on the Weekly Station Checklist.

B.2.1.4 Turn on the calibrator pump and the sample pump by activating Event 02 (Ozone Zero) by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	02 <ENTER>

This turns the O3 column off-line. On the chart paper, write "O3 off-line" along with the time, date, and your name. Record the time that the event was activated on the Weekly Station Checklist and in the Site Log Book.

NOTE: Immediately, the relays that activate the Dasibi 1003-PC sample pump, calibrator pump, and pneumatic isolation valve will be energized. This is evidenced by the increase in the noise level in the monitoring shelter with the activation of the pumps.

With the event activated by using the data logger, the data for the O3 and CAL will be flagged with a "C" suffix and the erroneous data generated as a result of the following instrument checks will not be included in the hourly average.

B.2.1.5 Verify that the calibrator pump flow meter reads approximately 5 lpm. Adjust if necessary noting the pre- and post-adjustment values on the Weekly Station Checklist.

B.2.1.6 Verify that the sample flow meter reads 1.5 to 2.0 lpm mid-ball. Adjust if necessary, and record the pre- and post-adjustment values on the Weekly Station Checklist.

B.2.1.7 Turn the function switch from the "Operate" to the "Sample Frequency" position. Observe the front panel display for a minimum of one minute. Record the displayed value on the Weekly Station Checklist. If the response is outside the optimum sampling frequency of 40-48, notify the OSC.

STATION: _____
WEEKLY STATION CHECKLIST
SECTION B.2.1 DASIBI MODEL 1003-PC CALIBRATOR

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.2.1.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	NPS PROPERTY NUMBER			
	CALENDAR DATE			
B.2.1.2	POWER ON? (Y/N)			
	SAMPLE PUMP SWITCH OFF? (Y/N)			
	CALIBRATOR PUMP SWITCH OFF?(Y/N)			
	OZONE CALIBRATOR LAMP SWITCH OFF?			
	AUTO/MANUAL SWITCH IN "AUTO"?			
	FUNCTION SWITCH IN "OPERATE"? (Y/N)			
B.2.1.3	"MAN O3 ADJ" THUMBWHEEL SETTING			
	"AUTO O3 ADJ" THUMBWHEEL SETTING			
B.2.1.4	EVENT 02 ACTIVATED @ LST			
B.2.1.5	UNADJUSTED CALIBRATOR PUMP ROTAMETER SETTING			
	ADJUSTED CALIBRATOR PUMP ROTAMETER SETTING (>4.5 LPM)*			
B.2.1.6	UNADJUSTED SAMPLE PUMP ROTAMETER SETTING			
	ADJUSTED SAMPLE PUMP ROTAMETER SETTING (1.5-2 LPM)*			
B.2.1.7	SAMPLE FREQUENCY (40-48) ** (RECORD VALUE)			
B.2.1.8	CONTROL FREQUENCY (20-28) ** (RECORD VALUE)			
B.2.1.9	INSTRUMENT SPAN SETTING			
B.2.1.10	FUNCTION SWITCH RETURNED TO "OPERATE"? (Y/N)			
B.2.1.11	EVENT 02 DEACTIVATED @ LST (?)			

* IF THE INSTRUMENT CANNOT BE ADJUSTED WITHIN RECOMMENDED LIMITS, CALL THE OSC **IMMEDIATELY** FOR ASSISTANCE.

** IF THE FREQUENCIES ARE OUTSIDE OF THESE RANGES, NOTIFY THE OSC **IMMEDIATELY**, BEFORE MAKING ANY ADJUSTMENTS.

Figure B.2.1-1. Sample Dasibi Model 1003-PC Calibrator Weekly Station Checklist.

NOTE: No adjustments are to be made to the Dasibi 1003-PC ozone calibrator by the station operator unless specifically instructed to do so by the OSC (reference instruction in the Site Log Book). Adjustments to the calibrator are to be made only by the OSC during semiannual site visits.

B.2.1.8 Turn the function switch from the "Sample Frequency" to the "Control Frequency" position and observe the front panel display for a minimum of one minute. Record the displayed value on the Weekly Station Checklist. If the response is outside the optimum control frequency, 20-28, notify the OSC as noted above.

B.2.1.9 Turn the function switch from the "Control Frequency" position to the "Span" position. Observe the display for a minimum of one minute. Record the displayed value on the Weekly Station Checklist. If the value has changed since the last site visit.

B.2.1.10 Return the function switch to the "Operate" position.

B.2.1.11 Once all checks on the Dasibi 1003-PC are complete, place the appropriate columns back on-line by deactivating the Ozone Zero which was activated in Step B.2.1.4. This is accomplished by performing one of the following procedures:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)	02 <ENTER>

If you are not at the prompt (>), deactivate the Ozone Zero by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
DEACTIVATE WHICH EVENT(S)	02 <ENTER>

NOTE: Immediately all relays should be deactivated. This is evidenced by the deactivation of the calibrator pump and the sample pump. The monitoring shelter will now be noticeably quieter.

On the O3 chart paper, write "O3 on-line" along with the time and date. Note in the Station Log Book when the channels were brought back on-line.

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Section	**B.2.2**
Title	**MONITOR LABS MODEL 8550 CALIBRATOR WITH MONITOR LABS 8810 TRANSFER STANDARD**
Effective Date	**DECEMBER 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS
0.1	12/94	Correction in title at top of page 1.	John F. Faust

B.2.2 Monitor Labs Model 8550 Calibrator With Monitor Labs 8810 Transfer Standard

PROCEDURES

B.2.2.1 Record the site name, operator name (first initial and full last name), the instrument serial number, the NPS property number, and the calendar date on the Weekly Station Checklist (see Figure B.2.2-1).

Note: B.2.2.2 through B.2.2.6 apply to the ML 8810 transfer standard.

B.2.2.2 Verify that the power is on (the POWER switch and the ozone concentration display should be illuminated).

B.2.2.3 Verify that the RANGE selector switch on the front of the ML 8810 ozone analyzer is in the 0.5 position (the RANGE light should be illuminated).

B.2.2.4 Turn on the calibrator pump and the sample pump by activating Event 02 (Ozone Zero) by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	02 <ENTER>

This turns the O3 column off-line. On the chart paper, write "O3 off-line" along with the time, date, and your name. Record the time that the event was activated on the Weekly Station Checklist and in the Site Log Book.

NOTE: Immediately, the relays that activate the ML 8810 transfer standard sample pump, calibration pump, and pneumatic isolation valve will be energized. This is evidenced by the increase in the noise level in the monitoring shelter with the activation of the pumps.

With the event activated by using the data logger, the data for the O3 and CAL will be flagged with a "C" suffix and the erroneous data generated as a result of the following instrument checks will not be included in the hourly average.

B.2.2.5 Record the sample pump rotameter reading on the Weekly Station Checklist. The reading should be between 0.5 to 0.7 lpm mid-ball. Adjust if necessary. Record the results on the Weekly Station Checklist.

B.2.2.6 Press the TEST switch on the front of the ML 8810 ozone analyzer and record the instrument display outputs. Several attempts will be necessary to record all of the values.

If the lamp voltage reading is outside of the 1.65 to 1.85 range, adjust the lamp voltage. Please contact the OSC for assistance if necessary. If the lamp is adjusted, record the adjusted lamp voltage value on the Weekly Station Checklist.

Note: B.2.2.7 through B.2.2.8 apply to the ML 8550 calibrator.

B.2.2.7 Verify the ML 8550 "Run" light is illuminated, the "ozone" switch is in position 6, the "Zero Air" switch is in the Run position, and the "Power" switch is on. Note on the station checklist if they are not correct settings if necessary and note any incorrect positions on the station checklist.

B.2.2.8 Verify that the ML 8550 "O3" flow meter indicates the predetermined ball height setting. Adjust if necessary, noting the pre- and post-adjustment values on the Weekly Station Checklist.

B.2.2.9 Once all checks on the ML 8810 transfer standard and ML 8550 calibrator are complete, place the appropriate columns back on-line by deactivating the Ozone Zero which was activated in Step B.2.4. This is accomplished by performing one of the following procedures:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)	02 <ENTER>

If you are not at the prompt (>), deactivate the Ozone Zero by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
DEACTIVATE WHICH EVENT(S)	02 <ENTER>

NOTE: Immediately all relays should be deactivated. This is evidenced by the deactivation of the calibrator pump and the sample pump. The monitoring shelter will now be noticeably quieter.

On the O3 chart paper, write "O3 on-line" along with the time and date. Note in the Station Log Book when the channels were brought back on-line.

STATION: _____
WEEKLY STATION CHECKLIST
SECTION B.2.2 MONITOR LABS ML 8810 TRANSFER STANDARD WITH MONITOR LABS ML 8550 CALIBRATOR

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.2.2.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	NPS PROP NUMBER			
	CALENDAR DATE			
B.2.2.2	POWER ON? (Y/N)			
B.2.2.3	RANGE 0.5? (Y/N)			
B.2.2.4	EVENT 02 ACTIVATED AT LST			
B.2.2.5	SAMPLE FLOW (0.5 - 0.7 LPM)			
	SAMPLE FLOW ADJUSTED (Y/N)			
	ADJUSTED FLOW RATE (0.5-0.7 LPM)*			
B.2.2.6	TEST MODE CHECK			
	A/D OK? (Y/N)			
	D/A OK? (Y/N)			
	LAMP READING (1.65-1.85)			
	TMP VALUE			
	PR VALUE			
	AB VALUE			
	T/C = O6? (Y/N)			
	RG = 0.5? (Y/N)			
	OFST = 10? (Y/N)			
	LAMP ADJUSTED? (Y/N)			
	FINAL LAMP VALUE (1.65-1.85) (OR NA)?			
B.2.2.7	"RUN" LIGHT ILLUMINATED, "OZONE" SWITCH IN 6, ZERO AIR SWITCH IN RUN, AND "POWER" SWITCH ON? NOTE IF NOT.			
B.2.2.8	UNADJUSTED ML 8550 "O3" FLOWMETER SETTING.			
	ADJUSTED ML 8550 "O3" FLOWMETER SETTING (OR NA)			

* IF THE INSTRUMENT CANNOT BE ADJUSTED WITHIN RECOMMENDED LIMITS, CALL THE OSC IMMEDIATELY FOR ASSISTANCE.

Figure B.2.2-1. Sample Monitor Labs ML 8810 Transfer Standard With Monitor Labs ML 8550 Calibrator.

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Section	**B.2.5**
Title	**THERMO ENVIRONMENTAL INSTRUMENTS (TECO) SERIES 146 DILUTION SYSTEM**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.2.5 Thermo Environmental Instruments (TECO) Series 146 Dilution System

PROCEDURES

B.2.5.1 Record the site name, operator name (first initial and full last name) instrument serial number, NPS property tag number, and calendar date on the Weekly Station Checklist (see Figure B.2.5-1).

B.2.5.2 Verify that the analyzer power is on. The "ON" switch on the front panel should be illuminated. If the switch is not illuminated, notify the OSC.

B.2.5.3 Record the position of the "REMOTE SWITCH" on the Weekly Station Checklist (the switch should be in). Automatic calibrations will not occur if the switch is out.

B.2.5.4 Ensure that the O3 is on and the gas switches (zero air, SO2, O3, A, B, & C) are all out.

B.2.5.5 Record the zero air potentiometer setting on the Weekly Station Checklist. The potentiometer is located inside the door on the front of the instrument.

B.2.5.6 Record the gas potentiometer setting on the Weekly Station Checklist. This is located inside the door on the front of the instrument near the zero potentiometer.

B.2.5.7 Ensure the zero air and gas flow values are correct by performing the following to activate an SO2 span event:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	01 <ENTER>

With the event activated by using the data logger, the data for the SO2, O3, and CAL will be flagged with a "C" suffix and the erroneous data generated as a result of the following calibrator checks will not be included in the hourly average.

Verify the zero air flow and the gas flow meter readings are as designated by the OSC during the previous semiannual visit. If necessary, adjust the thumbwheels until the meter readings are at their designated values. Record all "as found" and final readings on the Weekly Station Checklist. Deactivate the SO2 span event by performing the following:

SITE: _____
WEEKLY STATION CHECKLIST
SECTION B.2.5 THERMO ENVIRONMENTAL SERIES 146
DILUTION SYSTEM CALIBRATOR

RECORD THE FOLLOWING:	VISIT 1		VISIT 2		VISIT 3	
B.2.5.1 SITE OPERATOR						
INSTRUMENT SERIAL NUMBER						
NPS PROPERTY NUMBER						
CALENDAR DATE						
B.2.5.2 POWER ON ? (Y/N)						
B.2.5.3 REMOTE SWITCH IN ? (Y/N)						
B.2.5.4 O3 & ALL GAS SWITCHES OUT ? (Y/N)						
B.2.5.5 ZERO POT SETTING						
B.2.5.6 SPAN POT SETTING						
	As Found	Final	As Found	Final	As Found	Final
B.2.5.7 ZERO AIR FLOW (LPM)						
GAS FLOW (SCCM)						
B.2.5.8 ZERO AIR THUMBWHEEL SETTING						
B.2.5.9 GAS THUMBWHEEL SETTING						
B.2.5.10 PRIMARY PRESSURE GAUGE READING						
B.2.5.11 SECONDARY PRESSURE GAUGE READING						
B.2.5.12 GAS CYLINDER S/N _____						
DESIGNATED CONC. _____						
CERTIFICATION DATE _____						

Figure B.2.5-1. Sample Thermo Environmental (TECO) Series 146 Dilution System Calibrator Weekly Station Checklist.

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)?	01 <ENTER>

B.2.5.8 Record the final zero air thumbwheel setting on the Weekly Station Checklist. The thumbwheel is located on the front, right hand side of the instrument.

B.2.5.9 Record the final gas thumbwheel setting on the Weekly Station Checklist. The thumbwheel is located on the front, right hand side of the instrument.

B.2.5.10 Record the primary pressure gage reading (the first gage on the SO2 cylinder). If the pressure is less than 700 psig, notify the OSC immediately so a replacement cylinder may be ordered.

B.2.5.11 Record the secondary pressure gage reading (the second gage on the SO2 cylinder). This value should be between 20 and 30 psig.

B.2.5.12 Record the cylinder serial number and designated tank concentration on the Weekly Station Checklist. This information can be found on the tag attached to the tank output valve.

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Section	**B.3**
Title	**OZONE ANALYZERS**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.3 OZONE ANALYZERS

Ozone analyzers are sophisticated electro-optical instruments that can detect the presence and quantity of ozone in a sample of ambient air. All ozone analyzers in the NPS network are "continuous" analyzers and measure and report ozone concentrations continuously.

The ozone analyzers require EPA certification (provided by the manufacturer) that specify measurement limits, operating temperature, and other conditions to ensure accurate operation. The analyzers require routine calibration checks (provided automatically by the station calibrator) and routine operational parameter checks (performed by the station operator and recorded on checklists. Maintenance is performed routinely during semiannual visits from OSC personnel or on an as-needed basis by the station operator.

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Section	**B.3.1**
Title	**DASIBI MODELS 1003-AH, -PC, OR -RS OZONE ANALYZERS**
Effective Date	**DECEMBER 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS
0.1	12/94	Title correction on page 1, and removal of "& CAL" on line B.3.1.12 of Figure B.3.1-1 and Weekly Station Checklist for Dasibi Models 1003-AH, -PC, or -RS Ozone Analyzers.	John F. Faust

B.3.1 Dasibi Models 1003-AH, -PC, or -RS Ozone Analyzers

PROCEDURES

B.3.1.1 Record the site name, operator name (first initial and full last name), instrument serial number, NPS property tag number, and calendar date on the Weekly Station Checklist (see Figure B.3.1-1).

B.3.1.2 Verify that the power is on and the sample pump rotameter is reading 1.5 to 2.0 lpm mid-ball. The desired setting should be marked on the rotameter. Adjust the flow if necessary. Record the pre- and post-adjustment results. Notify the OSC if frequent adjustments are necessary.

B.3.1.3 Verify that the function switch is in the "Operate" position.

B.3.1.4 Since the following instrument checks will affect the instrument's analog voltage output, take the O3 column off-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	(SHIFT) #
CODE:	NPSAIR
DOWN WHICH COLUMN?	____ (for O3) <ENTER>
DOWN WHICH COLUMN?	<ENTER>

Note on the strip chart and in the Site Log Book the time the O3 column was taken off-line and verify that the SumX data logger has flagged the data by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E

A "D" should appear to the right of the values presented under the O3 column indicating that the column has been taken off-line or "downed."

Press ESCAPE <ESC> to return to the command mode and the ">" cursor.

Record the time the O3 column was taken off-line on the station checklist.

SITE: _____
WEEKLY STATION CHECKLIST
SECTION B.3.1 DASIBI MODELS 1003-AH, -PC, OR -RS OZONE ANALYZERS

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.3.1.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	NPS PROP NUMBER			
	CALENDAR DATE			
B.3.1.2	POWER ON? (Y/N)			
	SAMPLE FLOW (1.5-2 LPM)			
	FLOW ADJUSTED? (Y/N)			
	ADJUSTED FLOW RATE (1.5-2 LPM)*			
B.3.1.3	SWITCH IN "OPERATE"? (Y/N)			
B.3.1.4	O3 COLUMN OFF-LINE @ LST			
B.3.1.5	UNADJUSTED SAMPLE FREQUENCY (40-48)			
B.3.1.6	UNADJUSTED CONTROL FREQUENCY (20-28)			
B.3.1.7	FREQUENCIES ADJUSTED?			
B.3.1.8	ADJUSTED SAMPLE FREQUENCY (40-48)*			
	ADJUSTED CONTROL FREQUENCY (20-28)*			
B.3.1.9	INSTRUMENT SPAN SETTING			
B.3.1.10	FUNCTION SWITCH RETURNED TO "OPERATE"?			
B.3.1.11	SAMPLE LINE FILTER CHECKED?			
	SAMPLE LINE FILTER REPLACED?			
B.3.1.12	O3 COLUMN ON-LINE @ LST			
NOTE: IF THE SAMPLE LINE FILTER WAS CHANGED, PROCEED.				
B.3.1.13	O3 SPAN & ZERO ACTIVATED @ LST			

* IF THE INSTRUMENT CANNOT BE ADJUSTED WITHIN RECOMMENDED LIMITS, CALL OSC IMMEDIATELY FOR ASSISTANCE.

Figure B.3.1-1. Sample Dasibi Models 1003-AH, -PC, or -RS Ozone Analyzers Weekly Station Checklist.

B.3.1.5 Turn the function switch from the "Operate" to the "Sample Frequency" position. Observe the front panel display for a minimum of one minute. Record the displayed value on the Weekly Station Checklist. If the response is outside the optimum sampling frequency of 40-48, an adjustment will be necessary. See Paragraph B.3.1.7.

B.3.1.6 Turn the function switch from the "Sample Frequency" to the "Control Frequency" position and observe the front panel display for a minimum of one minute. Record the displayed value on the Weekly Station Checklist. If the response is outside the optimum control frequency of 20-28, an adjustment will be necessary (see Paragraph B.3.1.7).

B.3.1.7 To make the frequency adjustments, the top of the analyzer must be removed. Dasibis require an adjustment of the UV lamp and/or the frequency detectors to change frequencies. Contact the OSC or consult the Dasibi Operator's Manual for the proper frequency adjustment procedures. Do not make any potentiometer adjustments unless specifically instructed to do so by the OSC. Reference the instructions in the Site Log Book.

B.3.1.8 Record the adjusted sample and control frequency values on the Weekly Station Checklist.

NOTE: If sample and/or control frequency adjustments are made, be certain to check both frequency readings after the adjustments.

B.3.1.9 Turn the function switch from the "Control Frequency" position to the "Span" position. Observe the display for a minimum of one minute. Verify that the displayed value is equal to that denoted on the calibration seal affixed to the front of the instrument.

B.3.1.10 Return the function switch to "Operate."

B.3.1.11 Examine the in-line sample filter on a weekly basis for any discoloration due to dirt. Replace the filter a minimum of once every two weeks. Note the change on the Weekly Station Checklist and in the Site Log Book.

B.3.1.12 Once all checks on the Dasibi ozone analyzer are complete, place the appropriate column back on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	U
UP COLUMN NUMBER?	____ (for O_3) <ENTER>
UP COLUMN NUMBER?	<ENTER>

Verify the O3 column is on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMNS?	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E <ENTER>

The "D" to the right of the concentration under the O3 column should be replaced with a "P," which should be absent within 5 minutes. If not, repeat B.3.1.12. On the O3 chart paper, write "O3 on-line" along with the time and date. Note in the Site Log Book and on the Station Checklist when the channel was brought back on-line.

NOTE: Following an O3 sample line filter change, a span check is required to verify the integrity of the sampling system and to condition the new filter. The following paragraphs are to be completed following sample filter replacement:

B.3.1.13 Activate a span event and zero event in sequence to condition the new filter as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENTS IN SEQUENCE?	____ , ____, (for O3, SPAN and ZERO) <ENTER>

B.3.1.14 Within a minute, the first event, the O3 SPAN, will activate as indicated by the upscale deflection of the ozone strip chart recorder.

B.3.1.15 With events ____ and ____ activated in sequence, event ____, the O3 SPAN will run for approximately 30 minutes. After the completion of event ____, event ____, O3 ZERO, will be activated and will run for approximately 15 minutes.

B.3.1.16 Review the results of the span and zero events using the SumX data logger "Z" command either by returning to the station, or calling up the SumX data logger via telephone modem. If the results are outside recommended limits, contact the OSC.

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AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**B.3.2**
Title	**LEAR SIEGLER MODEL ML 8810 OZONE ANALYZER**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.3.2 Lear Siegler Model ML 8810 Ozone Analyzer

PROCEDURES

B.3.2.1 Record the site name, operator name (first initial and full last name), the instrument serial number, the NPS property number, and the calendar date on the Weekly Station Checklist (see Figure B.3.2-1).

B.3.2.2 Verify that the power is on (the POWER switch and the ozone concentration display should be illuminated).

B.3.2.3 Verify that the RANGE selector switch on the front of the ML 8810 ozone analyzer is in the 0.5 position (the RANGE light should be illuminated).

B.3.2.4 Record the sample pump rotameter reading on the Weekly Station Checklist. The reading should be between 0.5 to 0.7 lpm mid-ball. Adjust if necessary. Record the results on the Weekly Station Checklist.

B.3.2.5 Press the TEST switch on the front of the ML 8810 ozone analyzer and record the instrument display outputs. Several attempts will be necessary to record all of the values.

B.3.2.6 If the lamp voltage reading is outside of the 1.65 to 1.85 range, adjust the lamp voltage. Please contact the OSC for assistance if necessary. If the lamp is adjusted, record the adjusted lamp voltage value on the Weekly Station Checklist.

Note: Whether or not a lamp adjustment is needed, take the O3 column off-line for Step B.3.2.7 by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	(SHIFT) #
CODE:	NPSAIR
DOWN WHICH COLUMN ?	____ (for O3) <ENTER>
DOWN WHICH COLUMN ?	<ENTER>

Note on the Weekly Station Checklist, on the strip chart, and in the Site Log Book the time the O3 column was taken off-line. Verify that the SumX data logger has flagged the data by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E) ?	E

A "D" should appear to the right of the values presented under the O3 column indicating that the column has been taken off-line or "downed."

STATION: _____
WEEKLY STATION CHECKLIST
SECTION B.3.2 LEAR SIEGLER ML 8810 OZONE ANALYZER

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.3.2.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	NPS PROP NUMBER			
	CALENDAR DATE			
B.3.2.2	POWER ON? (Y/N)			
B.3.2.3	RANGE 0.5? (Y/N)			
B.3.2.4	SAMPLE FLOW (0.5 - 0.7 LPM)			
	SAMPLE FLOW ADJUSTED (Y/N)			
	ADJUSTED FLOW RATE (0.5-0.7 LPM)*			
B.3.2.5	TEST MODE CHECK			
	A/D OK? (Y/N)			
	D/A OK? (Y/N)			
	LAMP READING (1.65-1.85)			
	TMP VALUE			
	PR VALUE			
	AB VALUE			
	T/C = O.6? (Y/N)			
	RG = 0.5? (Y/N)			
	OFST = 10? (Y/N)			
B.3.2.6	O3 COLUMN OFF-LINE @ LST?			
	LAMP ADJUSTED? (Y/N)			
	ADJUSTED LAMP VALUE (1.65-1.85) (OR NA)?			
B.3.2.7	SAMPLE LINE FILTER CHECKED? (Y/N)			
	SAMPLE LINE FILTER REPLACED? (Y/N)			
B.3.2.8	O3 COLUMN ON-LINE @ LST?			
NOTE: IF THE SAMPLE LINE FILTER WAS CHANGED, PROCEED.				
B.3.2.9	O3 SPAN & ZERO ACTIVATED @ LST			

* IF THE INSTRUMENT CANNOT BE ADJUSTED WITHIN RECOMMENDED LIMITS, CALL THE OSC IMMEDIATELY FOR ASSISTANCE.

Figure B.3.2-1. Sample Lear Siegler Model ML 8810 Ozone Analyzer Weekly Station Checklist.

Press <ESC> to return to the command mode and the ">" prompt.

B.3.2.7 Check the sample line filter. The filter should be changed at least every 2 weeks or when noticeably dirty. Weekly filter changes may be required.

B.3.2.8 Place the appropriate column back on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	U
UP COLUMN NUMBER?	____ (for O3) <ENTER>
UP COLUMN NUMBER?	<ENTER>

Verify the O3 column is on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMNS?	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E <ENTER>

The "D" to the right of the concentration under the O3 column should be replaced with a "P," which should be absent within 5 minutes. If not, repeat B.3.2.7. On the O3 chart paper, write "O3 on-line" along with the time and date. Note in the Site Log Book and on the Weekly Station Checklist the time the channel was brought back on-line.

NOTE: Following an O3 sample line filter change, a span check is required to verify the integrity of the sampling system and to condition the new filter. The following paragraphs are to be completed following sample filter replacement:

Hit <ESC> to return to the ">" prompt.

B.3.2.9 Activate a span and zero in sequence to condition the new filter as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENTS IN SEQUENCE ?	____ , ____, <ENTER> (for the O3 SPAN and ZERO)

B.3.2.10 Within a minute, the first event, the O3 span, will activate as indicated by the upscale deflection of the ozone strip chart recorder. Record the starting time of the O3 SPAN in the Site Log Book, the Weekly Station Checklist, and the strip chart.

B.3.2.11 With events ____ and ____ activated in sequence, event ____, the O3 span, will run for approximately 30 minutes. After the completion of event ____, event ____, the O3 zero, will be activated and will run for approximately 15 minutes, at which time it will shut off automatically.

B.3.2.12 Review the results of the span and zero events using the SumX data logger "Z" command either by returning to the station, or calling up the SumX data logger via telephone modem. If the results are outside recommended limits, contact the OSC. (Recommended limits are between 0.350 and 0.450 ppm, with the difference between the CAL LEVEL 5 ACTUAL and O3 LEVEL 5 ACTUAL no greater than ±0.040 ppm.)

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Section	**B.3.3**
Title	**API MODEL 400 OZONE ANALYZER**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.3.3 API Model 400 Ozone Analyzer

PROCEDURES

B.3.3.1 Record the site name, operator name (first initial and full last name), instrument serial number, NPS property tag number, and calendar date on the Weekly Station Checklist (see Figure B.3.3-1).

B.3.3.2 Verify that the power is on and that the green sample light is illuminated. Scroll through the TEST button, recording each of the parameters as they appear on the message portion of the LCD. If these parameters are out of prescribed ranges (the ranges in parenthesis in Figure B.3.3-1), call the OSC before attempting any adjustments.

B.3.3.3 Since the following instrument checks will affect the instrument's analog voltage output, take the O3 column off-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	(SHIFT) #
CODE:	NPSAIR
DOWN WHICH COLUMN ?	01 (for O3) <ENTER>
DOWN WHICH COLUMN ?	<ENTER>

Note on the strip chart and in the Site Log Book the time the O3 column was taken off-line and verify that the SumX data logger has flagged the data by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E) ?	E

B.3.3.4 If any test parameters have been adjusted, list those parameters.

B.3.3.5 Return setup/test button to setup position by depressing once.

B.3.3.6 Examine the in-line sample filter on a weekly basis for any discoloration due to dirt. Replace the filter a minimum of once every two weeks. If the filter needs replacing, use the tweezers provided to avoid direct handling of the filter. Note the filter change on the Weekly Station Checklist and in the Site Log Book.

B.3.3.7 Following an O3 sample line filter change, a span check is required to verify the integrity of the sampling system and to condition the new filter.

After an in-line teflon filter is replaced, initiate span/zero events with the SumX data logger "C" command by performing the following:

SITE: _____
WEEKLY STATION CHECKLIST
SECTION B.3.3 API MODEL 400 OZONE ANALYZER

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.3.3.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	NPS PROP NUMBER			
	CALENDAR DATE			
B.3.3.2	POWER ON? (Y/N)			
	GREEN SAMPLE LIGHT ON?			
	TIME (LOCAL STANDARD TIME)			
	O3 MEAS (2500-4700 MV)			
	O3 REF (2500-4700 MV)			
	IZS REF (N/A)			
	PRES (0-1" HG BELOW AMBIENT PRES)			
	SAMPLE FLOW (700-900 CC/MIN)			
	SAMPLE TEMP (1°-5°C ABOVE AMBIENT)			
	ANA LAMP TEMP (52°C)			
	IZS LAMP TEMP (N/A)			
	BOX TEMP (1°-5°C ABOVE AMBIENT)			
	DCPS (2250-2750 MB)			
B.3.3.3	O3 COLUMN OFF-LINE @ LST			
B.3.3.4	LIST TEST PARAMETERS ADJUSTED, IF ANY.*			
B.3.3.5	SETUP/EXIT BUTTON RETURNED TO SETUP?			
B.3.3.6	SAMPLE LINE FILTER CHECKED? (Y/N)			
	SAMPLE LINE FILTER REPLACED? (Y/N)			
B.3.3.7	O3 SPAN & ZERO ACTIVATED @ LST			
	O3 ON-LINE @ LST			
B.3.3.8	O3 & CAL COLUMNS ON-LINE @ LST			

* IF THE INSTRUMENT CANNOT BE ADJUSTED WITHIN RECOMMENDED LIMITS, CALL THE OSC IMMEDIATELY FOR ASSISTANCE.

Figure B.3.3-1. Sample API Model 400 Ozone Analyzer Weekly Station Checklist.

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
ACTIVATE WHICH EVENTS IN SEQUENCE ?	01, 02 <ENTER>

Events 01 and 02 will "condition" the new filter and automatically deactivate in 45 minutes.

B.3.3.8 Once all checks on the API Model 400 are complete, place the appropriate columns back on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	U
UP COLUMN NUMBER?	____ (for Ozone) <ENTER>
UP COLUMN NUMBER?	<ENTER>

Verify the O3 column is on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMNS?	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E <ENTER>

The "D" to the right of the concentration under the O3 column should be replaced with a "P", which should be absent within 5 minutes. If not, repeat B.3.3.8. Record on the strip chart and in the Site Log Book the time and date the channel was brought back on-line.

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Section	**B.3.4**
Title	**THERMO ENVIRONMENTAL INSTRUMENT (TEI) 49 OZONE ANALYZER**
Effective Date	**JANUARY 1997**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator	John F. Faust	
NPS COTR	John D. Ray	J. Ray
NPS QA Officer		
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.3.4 TEI 49C Ozone Analyzer

PROCEDURES

B.3.4.1 Record the site name, operator name (first initial and full last name), the instrument serial number, the NPS property number, and the calendar date on the Weekly Station Checklist (see Figure B.3.4-1).

B.3.4.2 Take the O3 column off-line for Steps B.3.4.3 through B.3.4.7 by performing the following:

SUMX DATA LOGGER PROCEDURE

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	(SHIFT) #
CODE:	NPSAIR
DOWN WHICH COLUMN ?	____ (for O3) <ENTER>
DOWN WHICH COLUMN ?	<ENTER>

Note on the Weekly Station Checklist, on the strip chart, and in the Station Log book the time the O3 column was taken off-line. Verify that the SumX data logger has flagged the data by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E) ?	E

A "D" should appear to the right of the values presented under the O3 column indicating that the column has been taken off-line or "downed."

Press <ESC> to return to the command mode and the ">" prompt.

ODESSA DATA LOGGER PROCEDURE

TERMINAL DISPLAY	OPERATOR KEY-IN
	- (hyphen)
Up/Down Chan (1-G)-	7 (for O_3)
Up/Down Chan (1-G)-7 O7 U	D (to down Column 07)

B.3.4.3 Verify that the power is on (the "power" switch and the ozone concentration display should be illuminated).

B.3.4.4 Verify that the P/T ON pushbutton switch on the front of the ozone analyzer is in the ON position (pushed in) and the indicator light is illuminated.

STATION:
WEEKLY STATION CHECKLIST
SECTION B.3.4 TECO 49 OZONE ANALYZER

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.3.4.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	NPS PROP NUMBER			
	CALENDAR DATE			
B.3.4.2	O3 COLUMN OFF-LINE @ LST?			
B.3.4.3	POWER ON? (Y/N)			
B.3.4.4	P/T ON? (pushed in) (Y/N)			
	REMOTE INDICATOR ON? (Y/N)			
B.3.4.5	A SAMPLE FLOW (.85 - 1.15 LPM)*			
	B SAMPLE FLOW (.85 - 1.15 LPM)*			
B.3.4.6	TEST Pushbutton CHECKS			
	A FREQUENCY VALUE (70-120 kHz)			
	A FREQUENCY VALUE (<4.0 Hz)			
	B FREQUENCY VALUE (70-120 kHz)			
	B FREQUENCY NOISE (<4.0 Hz)			
	P/T VALUE CELL PRESSURE (mm Hg)			
	P/T VALUE CELL TEMPERATURE (DEG C)			
NOTE: PRESS	RUN TO RETURN TO MONITOR MODE.			
B.3.4.7	SPAN AND OFFSET THUMBWHEELS			
	SPAN VALUE (50 ∀10) OFST VALUE (50 ∀5)			
B.3.4.8	INSIDE SAMPLE LINE FILTER CHECKED? (Y/N)			
	INSIDE SAMPLE LINE FILTER REPLACED? (Y/N)			
B.3.4.9	O3 COLUMN ON-LINE @ LST?			
NOTE: IF THE INSIDE SAMPLE LINE FILTER WAS CHANGED, PROCEED.				
B.3.4.10	O3 SPAN & ZERO ACTIVATED @ LST			

* IF THE INSTRUMENT IS NOT WITHIN RECOMMENDED LIMITS, CALL THE OSC IMMEDIATELY ASSISTANCE.

Figure B.3.4-1. Sample TECO 49 Ozone Analyzer Weekly Station Checklist.

Verify that the "REMOTE" indicator lamp is illuminated. If not, note in the log book and press **REMOTE** to activate remote mode.

B.3.4.5 Record the A and B sample flow rotameter readings on the Weekly Station Checklist. The reading should be between 0.85 to 1.15 lpm mid-ball. Record the results on the Weekly Station Checklist. Call the OSC if the rotameter values are outside of these limits.

B.3.4.6 TEST Pushbutton Checks

Check Detector A frequency output by pressing **TEST A** on the front panel. Record the instrument display. Expected values are 70.000 to 120.000 kHz. Check Detector A frequency noise by pressing **TEST NOISE**. After 20 seconds, record the instrument display. Expected values are 4.0 Hz or less.

Check and record Detector B frequency and noise using the same procedure.

Check the cell pressure by pressing **TEST P/T** on the front panel. The actual (uncorrected) cell pressure will be displayed on the front panel. Record this value. Expected values depend upon instrument elevation and should be less than 760 mm Hg.

Check the cell temperature by pressing **TEST P/T** two times. The cell temperature in degrees Celsius will be displayed. Record this value.

NOTE: Press **RUN** to return the analyzer to monitor mode.

B.3.4.7 Record SPAN and Offset Thumbwheels Values

Observe the SPAN thumbwheel values and record on the Weekly Station Checklist. The value should by 500 $\forall$10.

Observe the OFFSET thumbwheel value and record on the Weekly Station Checklist. The value should be 50 $\forall$5.

B.3.4.8 Check the inside shelter sample line filter. The filter should be changed when noticeably dirty. This may be infrequent if an exterior flow tower filter is used.

B.3.4.9 Place the appropriate column back on-line by performing the following:

SUMX DATA LOGGER PROCEDURE

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	U
UP COLUMN NUMBER?	____ (for O3) <ENTER>
UP COLUMN NUMBER?	<ENTER>

Verify the O3 column is on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMNS?	____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E <ENTER>

The **D** to the right of the concentration under the O3 column should be replaced with a "P," which should be absent within 5 minutes. If not, repeat B.3.4.9. On the O3 chart paper, write "O3 on-line" along with the time and date. Note in the Station Log book and on the Weekly Station Checklist the time the channel was brought back on-line.

ODESSA DATA LOGGER PROCEDURE

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
	- (hyphen)
Up/down CHAN (1-G)-	7 (for O_3)
Up/down CHAN (1-G)-7 07 D	U (to up Column 07)

On the O_3 chart paper, write "O_3 on-line" along with the time and date. Note in the station log book and on the weekly station checklist the time the channel was brought back on-line.

NOTE: Following and inside O_3 sample line filter change, a SPAN check is required to verify the integrity of the sampling system and to condition the new filter. The following paragraphs are to be completed following sample filter replacement.

B.3.4.10 Activate a SPAN and ZERO in sequence to condition the new filter as follows:

SUMX DATA LOGGER

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENTS IN SEQUENCE ?	____ , ____, <ENTER> (for the O3 SPAN and ZERO)

ODESSA DATA LOGGER

TERMINAL DISPLAY	OPERATOR KEY IN
	A
0 DISABLE SEQ 1 START SEQ 2 START ONE PASS	

3 STOP SEQ	
4 SET BIT	
5 RESET BIT	2
2 START ONE PASS (A,1-4)	1 (Starts O_3 SPAN sequence)

B.3.4.11 Within a minute, the first event, the O3 SPAN, will activate as indicated by the upscale deflection of the ozone strip chart recorder. Record the starting time of the O3 SPAN in the Station Log book, the Weekly Station Checklist, and the strip chart.

B.3.4.12 With events ____ and ____ activated in sequence, event ____, the O3 SPAN, will run for approximately 30 minutes. After the completion of event ____, event ____, the O3 ZERO, will be activated and will run for approximately 15 minutes, at which time it will shut off automatically.

B.3.4.13 Review the results of the SPAN and ZERO events using the SumX data logger "Z" command either by returning to the station, or calling up the SumX data logger via telephone modem. If the results are outside recommended limits, contact the OSC. (Recommended limits are between 0.350 and 0.450 ppm, with the difference between the CAL LEVEL 5 ACTUAL and O3 LEVEL 5 ACTUAL no greater than $\forall$0.040 ppm.)

For Odessa users, type **H** to view calibration results.

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Section	**B.3.6**
Title	**THERMO ENVIRONMENTAL INSTRUMENT (TEI) SERIES 49C OZONE ANALYZER**
Effective Date	**January 1998**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator	Mark Tigges	
NPS COTR	Jack McPartland	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.3.6 Thermo Environmental Instrument (TEI) Series 49C Ozone Analyzer

B.3.6.1 Record the site name, operator name (first initial and full last name) instrument serial number, and calendar date on the Weekly Station Checklist (see Figure **B.3.6**-1).

B.3.6.2 Verify that the instrument screen on the TEI 49C is reporting O3 values in PPB units. Call the OSC anytime that a change to the program is required or the front panel reports an alarm.

B.3.6.3 Compare the O3 value on the instrument screen with the datalogger value on the Tandy Keyboard.

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	_____ (for O3) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E

Press ESCAPE <ESC> to return to the command mode and the ">" cursor. The difference should be within ∀3 ppb.

B.3.6.4 Push the **MENU** button on the TEI analyzer to access the MAIN MENU:

```
  MAIN MENU:      10:25
> RANGE
  AVERAGING TIME
  CALIBRATION FACTORS
```

Use the **ENTER** button to select the RANGE submenu. The menu should appear as shown below:

```
  RANGE:           SINGLE
> GAS UNITS          PPB
  RANGE              500
  SET CUSTOM RANGES
```

SITE: _____

WEEKLY STATION CHECKLIST

SECTION **B.3.6** TEI 49C OZONE ANALYZER

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.3.6.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	CALENDAR DATE			
B.3.6.2	INSTRUMENT SCREEN IN PPB UNITS? (Y/N)			
B.3.6.3 *	DO INSTRUMENT AND DATALOGGER O3 VALUES AGREE ±3PPB? (Y/N)			
B.3.6.4 *	RANGE SET TO 500 IN SINGLE MODE? (Y/N)			
B.3.6.5 *	AVERAGING TIME SET TO 60 SEC? (Y/N)			
B.3.6.6	CALIBRATION FACTORS: O3 BKG PPB?			
	O3 COEF?			
B.3.6.7 *	NEW CALIBRATION FACTORS (IF ADJUSTED) O3 BKG PPB?			
	O3 COEF?			
B.3.6.8 *	TEMPERATURE CORRECTION ON? (Y/N)			
	INSTRUMENT TEMPERATURE °C			
B.3.6.9 *	PRESSURE CORRECTION ON? (Y/N)			
	INSTRUMENT PRESSURE (mm Hg)			
B.3.6.10 *	FLOWS BETWEEN 0.4 AND 1.6 LPM? (Y/N)			
B.3.6.11 *	LAMP INTENSITY BETWEEN 45000 AND 150000? (Y/N)			
B.3.6.12	SAMPLE LINE FILTER CHANGED? (Y/N)			
B.3.6.13 OF	O3 LEVEL 5 ACTUAL FOLLOWING SAMPLE FILTER REPLACEMENT (MUST BE ±40 PPB O3 LEVEL 5 THEORETICAL VALUE)			
	O3 LEVEL 0 ACTUAL FOLLOWING SAMPLE FILTER REPLACEMENT (MUST BE ±3 PPB OF 0.0)			

* Notify the OSC if a change is necessary.

Figure B.3.6-1. Sample Thermo Environmental Inc. Model 49C Ozone Analyzer Weekly Station Checklist.

B.3.6.5 Press the **MENU** button once to return to the MAIN MENU:

```
  MAIN MENU:          10:31
> RANGE
  AVERAGING TIME
  CALIBRATION FACTORS
```

Press the DOWN ARROW **[↓]** button once to move the cursor to the AVERAGING TIME submenu. Now press **ENTER** to display AVERAGING TIME screen.

```
  AVG TIME          60 SEC
  SET TO            60 SEC
  ↑↓ SELECT
```

The averaging time should be set to 60 seconds.

B.3.6.6 Return to the MAIN MENU by pressing the **MENU** button once. Press the **[↓]** button once to move the cursor to the CALIBRATION FACTORS submenu.

```
  MAIN MENU:          10:36
  RANGE
  AVERAGING TIME
> CALIBRATION FACTORS
```

Press **ENTER** to display the CALIBRATION FACTORS screen.

```
  CALIBRATION FACTORS:
> O3 BKG PPB
  O3 COEF             1.019
```

Record the O3 BACKGROUND (O3 BKG), and the O3 Coefficient (O3 COEF) on the Weekly Station Checklist. Compare this weeks values to last weeks values. Call the OSC if a change not initiated by an operator has occurred.

B.3.6.7 Calibration factors can be adjusted if the OSC determines a change is required to linerarize the zero and span response.

Record the new calibration factors on the Weekly Station Checklist if changes are made.

B.3.6.8 Press the **MENU** button once to move back to MAIN MENU. Press the **[↓]** button two (2) times to access the INSTRUMENT CONTROLS submenu. Press **ENTER** once.

```
  INSTRUMENT CONTROLS:
> TEMP CORRECTION
  PRESSURE CORRECTION
  OZONATOR SOLENOID
```

Press **ENTER** again.

```
  TEMPERATURE     31.0◦C
  CORRECTION            ON
  TURN                 OFF?
```

The instrument cell TEMPERATURE should be displayed. Record the value on the WEEKLY STATION CHECKLIST.

CORRECTION should indicate ON. Record the result on the Weekly Station Checklist.

B.3.6.9 Press the **MENU** button once to return to the INSTRUMENT CONTROLS screen. Press **[↓]** once to move the cursor to the PRESSURE CORRECTION submenu.

```
  INSTRUMENT CONTROLS:
  TEMP CORRECTION
> PRESSURE CORRECTION
  FLASH LAMP
```

Press **ENTER** once.

```
  PRESSURE      723.7 mm Hg
  CORRECTION            ON
  TURN                 OFF?
```

Pressure is dependent upon station elevation and current atmospheric conditions. Record PRESSURE on the WEEKLY STATION CHECKLIST.

CORRECTION should indicate ON. Record the result on the Weekly Station Checklist.

B.3.6.10 Press the **MENU** button two (2) times to return to the MAIN MENU. Press the **[↓]** button one (1) time to move the cursor to the DIAGNOSTICS menu.

```
  MAIN MENU:        10:45
  CALIBRATION
  INSTRUMENT CONTROLS
> DIAGNOSTICS
```

Press the **ENTER** to display DIAGNOSTICS submenu.

```
  DIAGNOSTICS:
> PROGRAM NUMBERS
  VOLTAGES
  TEMPERATURES
```

Press the **[↓]** button four (4) times to move the cursor to the **FLOWS** submenu.

```
  DIAGNOSTICS:
  TEMPERATURES
  PRESSURE
> FLOWS
```

Press **ENTER** once to display the FLOWS screen.

```
  FLOWS
  CELL A        0.637 LPM
  CELL B        0.642 LPM
```

The FLOWS should be between 0.4 LPM and 1.6 LPM.

Note that the values are within the proper range on the checklist.

B.3.6.11 Press the **MENU** button once the return to the DIAGNOSTICS submenu. Press **[↓]** two (2) times to move the cursor to the

INTENSITIES submenu.

```
  DIAGNOSTICS:
  FLOWS
  CELL A/B O3
> INTENSITIES
```

Press **ENTER** once to display the INTENSITIES screen. INTENSITIES should be between 45,000 and 150,000.

```
  INTENSITIES:
  CELL A          98425
  CELL B          97465
```

Note that the values are in the proper range on the checklist.

Press the **RUN** button once to return to the RUN SCREEN.

B.3.6.12 Check the sample line particulate filter(s). Change the filter when it is visibly dirty or with a minimum frequency of every two weeks. Take the O3 column off line during the filter change.

NOTE: Following a O3 sample line filter change, a span check is recommended by NPS/ARD to verify the integrity of the sampling system. A span is performed following sample line filter replacement to condition the filter and to verify that the filter assembly and sample line connections are leak-free. If the site operator has access to the monitoring site (either by visiting the site or calling the site via modem), he/she should check the daily CALIBRATION-RESULTS on the DAILY SUMMARY following the filter replacement to verify that the filter was installed properly. If the monitoring site is not accessible, the site operator must perform a zero/span immediately following the sample filter replacement or be prepared to re-visit the site if a review of the polled data by monitoring support personnel indicates a problem following the filter replacement.

B.3.6.13 Record on the Weekly Station Checklist the results of the CALIBRATION RESULTS from the DAILY SUMMARY following the sample line filter replacement (O3 ACTUAL LEVEL 0 and 5). Verify that the span results are within the required control limits. If the ZERO/SPAN results are outside of the recommended limits, contact the OSC.

NATIONAL PARK SERVICE
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Section	**B.4.1**
Title	**LEAR SIEGLER MODEL ML 8850 SULFUR DIOXIDE ANALYZER**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.4.1 Monitor Labs Model 8850 Sulfur Dioxide Analyzer

B.4.1.1 Record the site name, operator name (first initial and full last name) instrument serial number, NPS property tag number, and calendar date on the Weekly Station Checklist (see Figure B.4.1-1).

B.4.1.2 Verify that the analyzer's power is on. The "POWER" light on the front panel should be illuminated. If the light is not illuminated, notify the OSC.

B.4.1.3 Verify that the "MODE" switch is in the "MONITOR" position. Notify the OSC if the switch is not found in the "MONITOR" position.

B.4.1.4 Check the analog meter on the front of the instrument. The meter should be reading between 0 and 20%. If the meter is outside of this range, contact the OSC.

B.4.1.5 Record on the Weekly Station Checklist the zero and span potentiometer settings.

B.4.1.6 Verify that the "RANGE PPM" switch is in the 0.5 position.

B.4.1.7 Record the sample flow on the Weekly Station Checklist. If the sample flow is not between 450 and 550 cc/min. at mid-ball, check the Swagelok fittings to the external sample pump and tighten if necessary. Record the adjusted flow on the Weekly Station Checklist and note in the Site Log Book that a flow adjustment was attempted. If frequent flow adjustments are necessary, notify the OSC.

B.4.1.8 Turn the "MODE" switch from the "MONITOR" position to "T1". There is no need to "down" the SO2 column since this does not affect the instruments analog output. Wait 30 seconds and record on the Weekly Station Checklist the analyzer's front panel meter reading using the 0 to 10 scale. The expected range of values for T1 on the 0 to 10 scale is 5 to 10. If the meter reading is not between 5 and 10, contact the OSC for instructions.

B.4.1.9 Turn the "MODE" switch from the "T1" to the "T2" position. Wait 30 seconds and record on the Weekly Station Checklist the meter reading using the 0 to 10 scale. The expected range of values for T2 on the 0 to 10 scale is 5 to 7. If the reading is not between 5 and 7, contact the OSC for instructions.

B.4.1.10 Turn the "MODE" switch from "T2" to the "T3" position. Wait 30 seconds and record on the Weekly Station Checklist the meter reading, using the 0 to 10 scale. The expected range of values for T3 on the 0 to 10 scale is 6.5 to 7.5. If the reading is not between 6.5 and 7.5, contact the OSC for instructions.

B.4.1.11 Return the "MODE" switch to the "MONITOR" position.

SITE: _____
WEEKLY STATION CHECKLIST
SECTION B.4.1 LEAR SIEGLER MODEL ML 8850 SULFUR DIOXIDE ANALYZER

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.4.1.1	SITE OPERATOR			
	INSTRUMENT SERIAL NUMBER			
	NPS PROPERTY NUMBER			
	CALENDAR DATE			
B.4.1.2	POWER LIGHT ON? (Y/N)			
B.4.1.3	MODE SWITCH TO MONITOR? (Y/N)			
B.4.1.4	ANALOG METER 0 TO 20%? (Y/N)			
B.4.1.5	ZERO POT SETTING			
	SPAN POT SETTING			
B.4.1.6	RANGE PPM SWITCH AT 0.5? (Y/N)			
B.4.1.7	SAMPLE FLOW READING (450 - 550 cc/min)			
	SAMPLE FLOW ADJUSTED? (Y/N)			
	ADJUSTED FLOW RATE? (450 - 550 cc/min)*			
B.4.1.8	"T1" OUTPUT (RANGE 5 TO 10)			
B.4.1.9	"T2" OUTPUT (RANGE 5 TO 7)			
B.4.1.10	"T3" OUTPUT (RANGE 6.5 TO 7.5)			
B.4.1.11	MODE SWITCH RETURNED TO MONITOR			
B.4.1.12	SAMPLE LINE FILTER CHANGED? (Y/N)			
B.4.2.13	SAMPLE LINE FILTER CHANGED? (Y/N)			
B.4.2.14	SO2 LEVEL 5 ACTUAL FOLLOWING SAMPLE FILTER REPLACEMENT (MUST BE ±0.008 PPM OF SO2 LEVEL 5 THEORETICAL VALUE)			
	SO2 LEVEL 0 ACTUAL FOLLOWING SAMPLE FILTER REPALCEMENT (MUST BE ±0.003 PPM OF 0.000)			

* If the sample flow cannot be adjusted to within this range, notify the OSC.

Figure B.4.1-1. Sample Monitor Labs Model 8850 Sulfur Dioxide Analyzer Weekly Station Checklist.

B.4.1.12 Check the sample line particulate filter. Change the filter when it is visibly dirty or with a minimum frequency of at least every two weeks.

NOTE: Following an SO2 sample line filter change, a span check is recommended by NPS/AQD to verify the integrity of the sampling system. Unlike ozone (which must have a span performed following sample line filter replacement to condition the filter) the SO2 span is performed solely to verify that the filter assembly and sample line connections are leak-free. If the site operator has access to the monitoring site (either by visiting the site or calling the site via modem), he/she should check the daily CALIBRATION-RESULTS on the DAILY SUMMARY following the filter replacement to verify that the filter was installed properly. If the monitoring site is not accessible, the site operator must perform a zero/span immediately following the sample filter replacement or be prepared to re-visit the site if a review of the polled data by monitoring support personnel indicates a problem following the filter replacement.

B.4.1.13 Record on the Weekly Station Checklist the results of the CALIBRATION-RESULTS from the DAILY SUMMARY following the sample line filter replacement (SO2 ACTUAL LEVEL 0 and 5). Verify that the span results are within the required control limits. If the ZERO/SPAN results are outside of the recommended limits, contact the OSC.

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Section	**B.5**
Title	**METEOROLOGICAL SYSTEMS**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.5 METEOROLOGICAL SYSTEMS

Meteorological monitoring commonly accompanies air quality monitoring. The meteorological data is required to better understand fluctuations in data beyond what would be considered "normal" and for inputs to computer models to predict adverse pollution conditions.

The meteorological monitoring performed at NPS air quality stations consists of the following:

- Single level horizontal wind speed and wind direction (typically 10 meters);
- Ambient temperature;
- Dew point or relative humidity;
- Solar radiation; and
- Precipitation.

The tower mounted sensors usually require signal translator cards to condition the sensors raw output into a useful scaled analog voltage that can be measured by the data logger. These signal translator cards are housed in a card cage or "mainframe" located in the air quality shelter.

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Section	**B.5.1**
Title	**CLIMATRONICS F-460 METEOROLOGICAL INSTRUMENTATION**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.5.1 Climatronics F-460 Meteorological Instrumentation

B.5.1.1 Record the station name, operator name (first initial and full last name) and calendar date on the Weekly Station Checklist (see Figure B.5.1-1).

B.5.1.2 Visually inspect the meteorological tower and instruments. Report any abnormalities (i.e., missing or broken anemometer cups, bent wind vanes, leaning towers, or loss of guy wires) to the OSC, and document the event in the Station Log Book.

Verify that the wind sensor's crossarm is orientated north to south, and the wind speed cups and the wind direction vane are freely rotating.

B.5.1.3 Verify that the aspirator motor for the temperature and dew point sensors is running.

B.5.1.4 Check the solar sensor. Make certain that the sensor is level. Re-level the sensor as necessary. If there is dirt or snow on the sensor, clean by wiping the surface of the sensor with a clean damp cloth. Note these problems in the Station Log Book since they will affect the accuracy of the solar radiation measurements.

B.5.1.5 Check the precipitation gauge. Note if there is any snow or leaves in the collection funnel. Remove the inlet (NOTE CAUTION BELOW) and note if there is dirt or debris in the tipping buckets. Clean if necessary. The sensor may be cleaned by flushing the tipping bucket with clean water. A soft brush may be used to clean out any dirt accumulation in the tipping bucket.

CAUTION: The bucket heater is supplied with 115 VAC. Disconnect the power supply from the precipitation gauge at the junction box (located on the tower) before removing the sensor top.

NOTE: Since cleaning the precipitation bucket will generate false rainfall readings when the bucket is tipped, prior to cleaning the precipitation gauge note in the Station Log and on the Weekly Station Checklist that the sensor is being cleaned.

B.5.1.6 Check the operation of the rainfall tipping bucket by performing the following:

B.5.1.6.1 Set the SumX data logger into the minute data collection mode by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	M
COLUMN NUMBER (?)	____ for RNF <ENTER>

PRESS THE ECHO (F5) AND TAP THE SPACE BAR SEVERAL TIMES TO UPDATE THE RAINFALL DATA EVERY MINUTE TO VIEW DATA FOR THE FOLLOWING TEST:

STATION: _____
WEEKLY STATION CHECKLIST
SECTION B.5.1 CLIMATRONICS F-460 METEOROLOGICAL INSTRUMENTATION

RECORD THE FOLLOWING:		VISIT 1		VISIT 2		VISIT 3	
B.5.1.1	SITE OPERATOR						
	DATE						
	WIND SENSORS AND TOWER SECURE?						
B.5.1.2	CROSSARM ORIENTED? (Y/N)						
B.5.1.3	ASPIRATOR MOTOR RUNNING? (Y/N)						
B.5.1.4	SNOW OR DIRT ON SOLAR SENSOR? (Y/N)						
	SOLAR SENSOR CLEANED? (Y/N)						
B.5.1.5	SNOW/LEAVES IN RAINFALL INLET? (Y/N)						
	DIRT/DEBRIS IN TIPPING BUCKET? (Y/N)						
	PRECIP GAUGE CLEANED? (Y/N)						
B.5.1.6	RNF BUCKET TIPPED 10 TIMES? (Y/N)						
B.5.1.7	INSTANTANEOUS VWD READING?						
	INSTANTANEOUS VWS READING?						
	INSTANTANEOUS SWS READING?						
	INSTANTANEOUS TMP READING?						
	INSTANTANEOUS DPT READING?						
	INSTANTANEOUS SOL READING?						
B.5.1.8	MET COLUMNS OFF LINE @ (LST)						
B.5.1.10	VWD ZERO VALUE (0 TO 2 DEG)						
	VWS ZERO VALUE (0.2 TO 0.3 M/S)						
	SWS ZERO VALUE (0.2 TO 0.3 M/S)						
	TMP ZERO VALUE (-50.5 TO -49.5°C)						
	DPT ZERO VALUE (-50.5 TO -49.5°C)						
	SOL ZERO VALUE (-0.020 TO 0.020 LNG)						
B.5.1.11	VWD SPAN VALUE (358 TO 362 DEG)						
	VWS SPAN VALUE (24 TO 26 M/S)						
	SWS SPAN VALUE (24 TO 26 M/S)						
	TMP SPAN VALUE (49.5 TO 50.5°C)						
	DPT SPAN VALUE (49.5 TO 50.5°C)						
	SOL SPAN VALUE (1.980 TO 2.020 LNG)						
B.5.1.12	VWD "540" VALUE (358 TO 362)						
B.5.1.13	SWITCHES RETURNED TO OPERATE?						
B.5.1.14	MET COLUMNS ON-LINE @ LST						

Figure B.5.1-1. Sample Climatronics F-460 Meteorological Instrumentation Weekly Station Checklist.

B.5.1.6.2 With the inlet funnel removed from the rain gauge, tip the measuring apparatus 10 times. Use caution to avoid the heater wires. **THESE WIRES CARRY 115 VAC**. Replace the rainfall bucket inlet. Make sure the wires do not interfere with the action of the tipping bucket and that the inlet is level.

B.5.1.6.3 Return to the TRS keyboard display. Observe if the tips were registered by the SumX data logger (you may have to wait until the end of the one minute period). If the tips were not registered or if no rainfall is measured by the data logger during periods of known rainfall, note this observation in the Station Log Book and notify the OSC.

B.5.1.7 Print an instantaneous output from the meteorological instrumentation (except rainfall) by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMNS ?	03, 04, 05, 06, 07, 08 <ENTER>

NOTE: The column numbers and the meteorological parameters may vary from station-to-station.

IN VOLTAGE OR ENGINEERING UNITS (V/E) ?	E

Press the SPACE BAR to update the column readings every five seconds. Enter the indicated SumX data logger values in the appropriate meteorological columns on the Weekly Station Checklist. Verify that the indicated values are representative of current meteorological conditions. Press <ESC> to return to the ">" prompt.

NOTE: The TRS keyboard has a 40 character display. When viewing more than three columns at a time, the display wraps around and is difficult to read. If the printer is activated by pressing the F5 (ECHO) key, on the TRS keyboard, the results are printed in a more readable format on the 80 column printer.

B.5.1.8 Take the meteorological columns (except for RNF) off-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	(SHIFT) #
CODE:	NPSAIR
DOWN WHICH COLUMN ?	__ (for Vector Wind Direction) <ENTER>
DOWN WHICH COLUMN ?	__ (for Vector Wind Speed) <ENTER>

DOWN WHICH COLUMN ?	__ (for Scaler Wind Speed) <ENTER>
DOWN WHICH COLUMN ?	__ (for Temperature) <ENTER>
DOWN WHICH COLUMN ?	__ (for Dew point) <ENTER>
DOWN WHICH COLUMN ?	__ (for Solar Radiation) <ENTER>

Note on the Weekly Station Checklist and in the Station Log Book the time that the meteorological columns were taken off-line.

B.5.1.9 Verify that the columns have been taken off-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	__, __, etc. <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E) ?	E

A "D" should appear to the right of the values presented under the meteorological data columns.

B.5.1.10 Set the mode switch on the front of each translator module to the ZERO position. Wait approximately one minute for the outputs to stabilize. Press the SPACE BAR on the keyboard to obtain the zero response from the translator. Check the printout and verify that the ZERO values are as follows:

COLUMN	PARAMETER	EXPECTED ZERO VALUE
03	Vector Wind Direction (VWD)	0 to 2 degrees
04	Vector Wind Speed (VWS)	0.2 to 0.3 M/S
05	Scaler Wind Speed (SWS)	0.2 to 0.3 M/S
06	Temperature (TMP)	-50.5 to -49.5°C
07	Dew Point (DPT)	-50.5 to -49.5°C
08	Solar Radiation (SOL)	-0.020 to +0.020 LNG

If any output does not fall in its respective range notify the OSC for the appropriate corrective actions. Record the "as found" and the "adjusted to" (if applicable) values on the Weekly Station Checklist and in the Station Log Book.

B.5.1.11 Set the mode switch on the front of each translator to the SPAN position. Wait approximately one minute for the outputs to stabilize. Press the SPACE BAR on the keyboard to obtain five second updates of the SPAN response. Check the printout to verify that the SPAN values are as follows:

COLUMN	PARAMETER	EXPECTED SPAN VALUE
03	Vector Wind Direction (VWD)	358 to 362 degrees
04	Vector Wind Speed (VWS)	24.0 to 26.0 M/S
05	Scaler Wind Speed (SWS)	24.0 to 26.0 M/S
06	Temperature (TMP)	49.5 to 50.5°C
07	Dew Point (DPT)	49.5 to 50.5°C
08	Solar Radiation (SOL)	1.980 to 2.020 LNG

If any output does not fall in its respective range, notify the OSC for the appropriate corrective actions. Record the "as found" and "adjusted to" (if applicable) values on the Weekly Station Checklist and in the Station Log Book.

B.5.1.12 Set the mode switch on the front of the wind translator to the "540" position. Wait one minute for the output to stabilize. Verify that the SumX data logger VWD column reads 360.0 ±2.0 degrees. If the output does not fall in its respective range, notify the OSC for the appropriate corrective action. Record the "as found" and "adjusted to" (if applicable) value on the Weekly Station Checklist and in the Station Log Book.

B.5.1.13 Return all mode switches to the OPERATE position (the red lights should go off). Wait one minute for the output to return to normal operation. Press the SPACE BAR on the keyboard and verify that all outputs are consistent with the ambient conditions. Press <ESC> to obtain the ">" cursor.

B.5.1.14 Place the meteorological columns back on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	U
UP COLUMN NUMBER ?	__ (for Vector Wind Direction) <ENTER>
UP COLUMN NUMBER ?	__ (for Vector Wind Speed) <ENTER>
UP COLUMN NUMBER ?	__ (for Scaler Wind Speed) <ENTER>
UP COLUMN NUMBER ?	__ (for Temperature) <ENTER>
UP COLUMN NUMBER ?	__ (for Dew point) <ENTER>
UP COLUMN NUMBER ?	__ (for Solar Radiation) <ENTER>

Verify the columns are on-line by repeating Paragraph B.5.1.9.

B.5.1.15 The "D" to the right of the values under the meteorological columns should be replaced with a "P", which should be absent within five minutes. If not, repeat Paragraph B.5.1.14.

B.5.1.16 Make certain that the ECHO (F5) has been de-activated so the printer is no longer printing characters from the TRS Keyboard Display.

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Section	**B.5.2**
Title	**WEATHERMEASURE/WEATHERTRONICS METEOROLOGICAL SYSTEM PROCEDURES**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.5.2 WeatherMeasure/Weathertronics Meteorological System Procedures

B.5.2.1 Record the station name, operator name (first initial and full last name) and calendar date on the Weekly Station Checklist (see Figure B.5.2-1).

B.5.2.2 Visually inspect the meteorological tower and instruments. Report any abnormalities (i.e., missing or broken anemometer cups, bent wind vanes, leaning towers, or loss of guy wires) to the OSC and document the event in the Station Log Book.

B.5.2.3 Verify that the wind sensor's crossarm is orientated north to south (or east to west depending upon the installation), and the wind speed cups and the wind direction vane are freely rotating.

B.5.2.4 Verify that the aspirator motor for the temperature and dew point sensors is running.

B.5.2.5 Print an instantaneous output from all the meteorological instrumentation by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMNS?	__, __, __, __, __, __, <ENTER> (for all met columns except RNF)
IN VOLTAGE OR ENGINEERING UNITS ? (V/E)	E

NOTE: The TRS keyboard has a 40 character display. When viewing more than three columns at a time, the display wraps around and is difficult to read. If the printer is activated by pressing the F5 (ECHO) key on the TRS keyboard, the results are printed in a more readable format on the 80 column printer.

Press the SPACE BAR to update the column readings every five seconds. Record the indicated SumX data logger values in the appropriate meteorological columns on the Weekly Station Checklist. Verify that the indicated values are representative of current meteorological conditions.

B.5.2.6 Check the precipitation gauge. Note if there is any snow or leaves in the collection funnel. Remove the inlet (NOTE CAUTION BELOW) and note if there is dirt or debris in the tipping buckets. Clean if necessary. The sensor may be cleaned by flushing the tipping bucket with clean water. A soft brush may be used to clean out any dirt accumulation in the tipping bucket.

CAUTION: The bucket heater is supplied with 115 VAC. Disconnect the power supply from the precipitation gauge at the junction box (located on the tower) before removing the sensor top.

STATION: _____ OPERATOR: _____
WEEKLY STATION CHECKLIST
SECTION B.5.2 WEATHERMEASURE/WEATHERTRONICS METEOROLOGICAL SYSTEM

RECORD THE FOLLOWING:	VISIT 1	VISIT 2	VISIT 3
B.5.2.1 SITE OPERATOR			
DATE			
B.5.2.2 WIND SENSORS AND TOWER SECURE?			
B.5.2.3 CROSSARM ORIENTED? (Y/N)			
B.5.2.4 ASPIRATOR MOTOR RUNNING? (Y/N)			
B.5.2.5 INSTANTANEOUS VWD READING?			
INSTANTANEOUS SWS READING?			
INSTANTANEOUS TMP READING?			
INSTANTANEOUS DPT READING?			
INSTANTANEOUS SOL READING?			
B.5.2.6 SNOW/LEAVES IN RAINFALL INLET? (Y/N)			
DIRT/DEBRIS IN TIPPING BUCKETS? (Y/N)			
PRECIP GAUGE CLEANED? (Y/N)			
B.5.2.7 RNF BUCKET TIPPED 10 TIMES? (Y/N)			
B.5.2.8 MET COLUMNS OFF LINE @ (LST)			
B.5.2.9 VWD LO VALUE (O TO 2 DEG)			
VWS LO VALUE (0.1 TO 0.2 MPH)			
SWS LO VALUE (0.1 TO 0.2 MPH)			
TMP LO VALUE (-50.5 TO -49.5°C)			
DPT LO VALUE (-50.5 TO -49.5°C)			
SOL LO VALUE (-10 TO 10 WMS)			
B.5.2.10 VWD 360 VALUE (358 TO 362 DEG)			
VWS HI VALUE (___TO ___MPH)*			
SWS HI VALUE (___TO ___MPH)*			
TMP HI VALUE (49.5 TO 50.5°C)			
DPT HI VALUE (49.5 TO 50.5°C)			
SOL HI VALUE (1480 TO 1520 WMS)			
B.5.2.11 VWD +360 VALUE (358 TO 362)			
B.5.2.12 SWITCHES RETURNED TO OPERATE?			
B.5.2.14 MET COLUMNS ON-LINE @ LST			

* These values depend on the wind speed calibration oscillator.

Figure B.5.2-1. Sample WeatherMeasure/Weathertronics Meteorological System Weekly Station Checklist.

NOTE: Since cleaning the precipitation bucket will generate false rainfall readings when the bucket is tipped, prior to cleaning the precipitation gauge, note in the Station Log and on the Weekly Station Checklist that the instrument is being cleaned.

B.5.2.7 Check the operation of the rainfall tipping bucket by performing the following:

B.5.2.7.1 Set the SumX data logger into the minute data collection mode by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	M
COLUMN NUMBER (?)	____ for RNF <ENTER>

PRESS THE ECHO (F5) AND TAP THE SPACE BAR SEVERAL TIMES TO UPDATE THE RAINFALL DATA EVERY MINUTE TO VIEW DATA FOR THE FOLLOWING TEST:

B.5.2.7.2 With the inlet funnel removed from the rainfall gauge, tip the measuring apparatus 10 times. Use caution to avoid the heater wires. **DANGER - THESE WIRES CARRY HIGH VOLTAGE - 115 VAC!** Replace the inlet funnel. Make sure the wires do not interfere with the action of the tipping bucket and that the inlet is level.

B.5.2.7.3 Return to the TRS keyboard display. Observe if the tips were registered by the SumX data logger (you may have to wait until the end of the one minute period). If the tips were not registered or if no rainfall is measured by the data logger during periods of known rainfall, note this observation in the Station Log Book and notify the OSC.

B.5.2.8 Take all the Meteorological columns off-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
	<ESC> to return to ">" prompt
>	(SHIFT) #
CODE:	NPSAIR
DOWN WHICH COLUMN?	__ (for Vector Wind Direction) <ENTER>
DOWN WHICH COLUMN?	__ (for Vector Wind Speed) <ENTER>
DOWN WHICH COLUMN?	__ (for Scaler Wind

	Speed) <ENTER>
DOWN WHICH COLUMN?	__ (for Temperature) <ENTER>
DOWN WHICH COLUMN?	__ (for Dew Point) <ENTER>
DOWN WHICH COLUMN?	__ (for Solar Radiation) <ENTER>
	<ENTER> to return to the > prompt.

Note on the Weekly Station Checklist and in the Station Log Book the time that the meteorological columns were taken off line.

B.5.2.8.1 Verify that the columns have been taken off-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	__, __, etc. <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E) ?	E

A "D" should appear to the right of the values presented under all of the meteorological columns.

B.5.2.9 Set the mode switch on the front of each translator module to the "LO" position. Note that the red "CAL" light will illuminate. Wait approximately one minute for the outputs to stabilize. Press the SPACE BAR on the TRS keyboard to obtain five second updates of the zero response from the translator.

Check the printout and verify that the LO values are as follows:

COLUMN	PARAMETER	EXPECTED LO VALUE
03	Vector Wind Direction (VWD)	0 to 2 DEG
04	Vector Wind Speed (VWS)	0.1 to 0.2 MPH
05	Scaler Wind Speed (SWS)	0.1 to 0.2 MPH
06	Temperature (TMP)	-50.5 to -49.5°C
07	Dew Point (DPT)	-50.5 to -49.5°C
08	Solar Radiation (SOL)	-10 to 10 WMS

If any output does not fall in its respective range, notify the OSC for the appropriate corrective actions. Record the "as found and the "adjusted to" (if applicable) values on the Weekly Station Checklist and in the Station Log Book.

B.5.2.10 Set the mode switch on the front of each translator to the "HI" position. Wait approximately one minute for the span outputs to stabilize. Press the SPACE BAR on the keyboard to obtain five second updates of the HI response from the translator. Check the printout to verify that the values are as follows:

COLUMN	PARAMETER	EXPECTED HI VALUE
03	Vector Wind Direction (VWD)	358 to 362 DEG
04	Vector Wind Speed (VWS)	____ to ____ MPH *
05	Scaler Wind Speed (SWS)	____ to ____ MPH *
06	Temperature (TMP)	49.5 to 50.5°C
07	Dew Point (DPT)	49.5 to 50.5°C
08	Solar Radiation (SOL)	1480 to 1520 WMS

* These values depend on the wind speed calibration oscillator and will be determined during semiannual visits.

If any output does not fall in its respective range, notify the OSC for the appropriate corrective actions. Record the "as found" and "adjusted to" (if applicable) values on the Weekly Station Checklist and in the Station Log Book.

B.5.2.11 Set the wind direction translator switch to the "+360" position. Wait approximately one minute for the span outputs to stabilize. Press the SPACE BAR on the keyboard to obtain five second updates from the translator. Verify that the SUMX VWD column readout is between 358 and 362. Record the value on the Weekly Station Checklist. If the output does not fall within this range, contact the OSC.

B.5.2.12 Return all mode switches to the "OPR" position. Note that the red "CAL" lights should go off. Wait one minute for the output to return to normal operation. Press the SPACE BAR on the TRS keyboard and verify that all outputs are consistent with the ambient conditions. Press <ESC> to return to the ">" prompt.

NOTE: If the printer has been used to record the zero and span results, press the F5 (ECHO) key on the TRS keyboard to de-activate the printer.

B.5.2.13 Place the meteorological columns back on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	U
UP COLUMN NUMBER?	__ (for Vector Wind Direction) <ENTER>
UP COLUMN NUMBER?	__ (for Vector Wind Speed) <ENTER>
UP COLUMN NUMBER?	__ (for Scaler Wind Speed) <ENTER>
UP COLUMN NUMBER?	__ (for Temperature) <ENTER>
UP COLUMN NUMBER?	__ (for Dew point) <ENTER>
UP COLUMN NUMBER?	__ (for Solar Radiation) <ENTER>

Verify that the columns are on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	__, __, etc. <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E) ?	E

The "D" to the right of the values under the Meteorological columns should be replaced with a "P", which should be absent within five minutes. If not, repeat the procedure.

B.5.2.14 Note on the Weekly Station Checklist and in the Station Log Book the time that the meteorological columns were put back on-line.

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Section	**B.6**
Title	**STRIP CHART RECORDERS, PRINTERS, MODEMS, AND MISCELLANEOUS EQUIPMENT**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.6 STRIP CHART RECORDERS, PRINTERS, MODEMS, AND MISCELLANEOUS EQUIPMENT

B.6.1 Introduction

B.6.1.1 Record the site name, operator name (first initial and last name), and calendar date, on the Weekly Station Checklist (see Figure B.6-1).

B.6.2 Strip Chart Recorder(s)

B.6.2.1 Record the strip chart model number, serial number, and NPS property tag number on the Weekly Station Checklist.

B.6.2.2 Compare the time denoted on the strip chart against that displayed on the SumX data logger. If the difference is greater than five minutes, adjust the chart accordingly and note the change on the strip chart and in the Site Log Book.

NOTE: If the chart is fast, advance the chart to set the correct time. Never adjust the chart backwards to set the correct time.

B.6.2.3 Make certain that the chart recorder is recording a legible trace. If the chart pen appears to be drying out, replace the pen immediately.

B.6.2.4 At the end of the two week sampling period (mid-month and at the end of the month) remove the chart paper and install new chart paper. This should be done a few minutes before the hour or half hour or, at the very least, checked again on the next hour or half hour after the paper is changed. Set the chart paper to Local Standard Time and annotate as follows:

a. Site Name

b. Start Date and End Date of the Strip chart

c. Operator's First Initial and Full Last Name

d. Gaseous Pollutant Parameters (O3, SO2) and Pen Color (applicable on multiple pen recorders)

e. Note if it is the "BEGINNING OF CHART" or "END OF CHART"

f. Date and Local Standard Time "ON LINE" or "OFF LINE"

g. Enter the Equation(s) Used to Calculate the Pollutant Concentration from the Chart Percent

B.6.2.5 Complete Section A.2.3, Weekly Ozone Zero/Span/Precision Check Control Charts and Maximum Hourly Average Concentration Verification Form, which gives detailed instructions for comparing hourly averages obtained from the SumX data logger to the hourly averages obtained from the strip charts. Report any unusual chart traces to OSC personnel immediately. After review, the strip charts are sent to the DPC according to procedures in Section A.

STATION: _____
WEEKLY STATION CHECKLIST
SECTION B.6 STRIP CHART RECORDERS, PRINTERS, MODEMS AND MISCELLANEOUS EQUIPMENT

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3
B.6.1	SITE OPERATOR			
	CALENDAR DATE			
B.6.2	STRIP CHART RECORDER			
B.6.2.1	STRIP CHART RECORDER MODEL NO			
	STRIP CHART RECORDER SERIAL NO			
	STRIP CHART RECORDER NPS NO			
B.6.2.2	SUMX TIME (LOCAL STANDARD TIME)			
	RECORDER TIME			
	RECORDER TIME ADJUSTED? (Y/N)			
B.6.2.3	CHART RECORDER INKING LEGIBLY			
B.6.2.4	CHART PAPER CHANGED? (Y/N)			
B.6.3	MISCELLANEOUS HARDWARE			
B.6.3.1	PRINTER RIBBON INKING LEGIBLY			
	PRINTER PAPER SUPPLY ADEQUATE			
	CHART PAPER SUPPLY ADEQUATE?			
B.6.3.2	SILICA GEL IN ZAS REPLACED?			
B.6.3.3	CHARCOAL IN ZAS REPLACED?			
B.6.3.4	MODEM POWER ON?			
	MODEM CONNECTED?			
B.6.3.5	TRS KEYBOARD "ECHO" OFF?			
	TRS KEYBOARD TURNED OFF?			
B.6.3.6	PRINTER POWER LEFT ON?			
B.6.4	LST (LOCAL STANDARD TIME) LEFT SITE			

Figure B.6-1. Sample Strip Chart Recorders, Printers, Modems, and Miscellaneous Equipment Weekly Station Checklist.

B.6.3 Miscellaneous Hardware

B.6.3.1 Verify that the printer ribbon is inking properly and that the site is supplied with enough printer paper for the next visit. If printer supplies are low, request additional supplies from the OSC.

B.6.3.2 Replace the silica gel desiccant, if utilized, whenever 70% of column is no longer blue. Remove the desiccant from the container. Spread evenly on a cookie sheet. Bake in the oven at 300°F for three (3) hours. Upon drying, the blue indicator will be uniform throughout the desiccant.

B.6.3.3 Replace the zero air canister with fresh charcoal every six months. Note on the card affixed to the side of the charcoal column the date that the charcoal was replaced. Discard the used charcoal.

B.6.3.4 Verify that the modem is on and the transmission lines are connected properly.

B.6.3.5 Turn "ECHO" on the TRS keyboard off to deactivate the printer, leave SumX data logger in Password mode (type "!" at the prompt), and turn off display.

B.6.3.6 Leave the printer power on.

B.6.4 Time Out

Record the Local Military Standard Time (LST) when all maintenance and checks are complete. Verify all doors are locked and secure.

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Section	**B.7**
Title	**NDDN FILTER PACK SAMPLES**
Effective Date	**DECEMBER 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator	Mark Tigges	
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other	John Faust	

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.7 NDDN FILTER PACK SAMPLES

Acidic deposition and its impact on the environment is a major concern. The accurate measurement of deposition rates are key to understanding the environmental consequences. This acidic deposition occurs via two primary pathways: "wet deposition", and "dry deposition." Wet deposition is commonly referred to as acid rain and occurs as the result of precipitation events (rain and snow), which remove acidic particles and gases from the atmosphere. Dry deposition is the transfer of these particles and gases to trees, plants, water surfaces, and soils in the absence of precipitation. Wet deposition rates are being measured by the National Atmospheric Deposition Program (NADP) by field and laboratory analysis of wet deposition samples. The U.S. EPA is sponsoring a National Dry Deposition Network (NDDN) to help estimate the dry deposition rates. These dry deposition rates determined from mass and chemical analysis of filters, meteorological, and biological information will ultimately be used to:

1) Document short- and long-term trends;
2) Calculate mass budgets;
3) Evaluate models; and
4) Support studies of deposition effects.

The NPS working in cooperation of the EPA has adapted the NDDN protocols for use at selected monitoring stations. The equipment involved includes a laboratory prepared filter sampling pack, air pump and flow controller, timing systems, and a 10-meter tiltover sampling tower. The filter packs are returned to the laboratory after field exposure for quantification of atmospheric sulfur and nitrate concentrations.

The procedures for field operators are detailed in the following sections. Careful handling of the filter pack and accurate recording of field observations are essential for successful sampling.

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Section	**B.7.1**
Title	**NDDN FILTER PACK CHANGE PROCEDURES**
Effective Date	**JUNE 1996**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator	Mark Tigges	
NPS COTR	John D. Ray	
NPS QA Officer	John D. Ray	
Other	John Faust	

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.7 NDDN FILTER PACK SAMPLING

The EPA supports a National Dry Deposition Network (or NDDN) to help estimate atmospheric dry deposition rates. The National Park Service, working in cooperation with the EPA, has adopted the NDDN protocols for use at selected monitoring stations. The dry deposition rates determined from analysis of filters will ultimately be used to document trends and evaluate biological effects.

The equipment involved includes a laboratory-prepared filter sampling pack, an air pump and flow controller, an hour meter, and a 10-meter sampling tower. After field exposure for approximately one week, the filter packs are returned to the laboratory for measurement of atmospheric sulfur and nitrate concentrations.

To confirm that all systems are in good operational condition and that filters are handled correctly, the operator is required to check each component and change filters weekly.

A mailing tube is sent to your site monthly by QST Environmental, in Gainesville, Florida. In each tube you will find a sample filter pack enclosed in a Ziplock bag and a Site Status Report Form (SSRF). Filters are generally changed each Tuesday.

PROCEDURES

B.7.1.1 Begin this week's filter change by completing the SSRF from last week. In the "Filter Off" column on last week's SSRF, record the rotameter reading observed at the middle of the ball.

B.7.1.2 Obtain the most recent SumX data logger's 5 minute average for the "Filter Off" "DAS Flow" entry by printing out the current SumX hourly report. Do so by entering:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	H <ENTER>

Locate the last flow rate value on the printed summary. This is the Data Acquisition System (DAS) flow. Record this on last week's SSRF. Turn off the "echo by pressing F5"again.

B.7.1.3 To change the filter, the flow tower must be lowered. Since the ozone inlet is also located on the tower, both the "Ozone" (O3) and "Flow" (FLW) columns must be taken offline.

B.7.1.4 "Down" the ozone and flow columns by entering:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	<Shift><#> (Press keys simultaneously)
CODE	NPSAIR
DOWN WHICH COLUMN ?	___(for O3)<ENTER> <ENTER>

Locate the last flow rate value on the printed summary. This is the Data Acquisition System (DAS) flow. Record this on last week's SSRF. Turn off

DOWN WHICH COLUMN ?	___(for FLW)<ENTER>
DOWN WHICH COLUMN ?	<ENTER>

B.7.1.5 Note on the strip chart and in the Site Log Book the time the columns were downed. Verify that the SumX data logger has flagged the data by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMN(S)	___ ___(for O3 and FLW) <ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E

A "D" should appear to the right of the values presented, indicating that the columns have been taken offline or "downed."

The <ESC> key will return the SumX data logger to the ">" prompt.

B.7.1.6 Turn off or unplug the flow pump and the hour meter. Record the hour meter reading on last week's SSRF in the "Elapsed Time" box.

B.7.1.7 Lower the flow tower only during good weather (i.e., no electrical storms, high winds, heavy ice buildup, or obvious tower damage). First remove the locking pin to allow the tower to be lowered. Then gently control its descent with the attached rope. Secure the tower by tying the rope to the base.

B.7.1.8 Wearing clean vinyl gloves (provided by the OSC), remove the filter pack from the tower by pulling back on the locking ring of the quick disconnect. Once the filter is removed, the quick disconnect provides an airtight seal. Insert the plastic caps that were saved in the shipping container to avoid contamination to the filter. Place the filter pack in its Ziplock bag. Enter the date and time for "Filter Off" on last week's SSRF form. Remove your gloves and discard them.

B.7.1.9 Observe the current reading of the Mass Flow Controller (MFC) display. It should be close to zero. Make a note of the value. Turn on the pump to leak check the sampling system. Let the MFC value stabilize and record the value in the "MFC Leak Check" box on last week's SSRF. The new value should also be close to zero. Call the OSC if the zero value is different now than before the pump was turned on. Now turn off the pump.

B.7.1.10 Record the expected ship date, then sign and date the form on the "Prepared By" line. At this point, last week's SSRF should be complete. The white copy and the filter you just removed can be packed in last week's mailing tube for shipment to ESE. The yellow and gold SSRF copies should be sent to the OSC, even though the form says to send these to ESE. The pink copy remains in your station notebook.

B.7.1.11 Check the water trap/drop bottle located inside the shelter

at the bottom of the 3/8" vinyl tubing. If any water is in the trap, empty it, and record this in the "Notes" box.

Note: Leaks are common at the water trap. Make sure to seal the trap completely if opened.

B.7.1.12 If you emptied water from the water trap or disturbed any other NDDN plumbing fittings, repeat the leak check procedure. Record the "MFC Leak Check" results in the "Filter On" column of this week's SSRF.

B.7.1.13 Enter the codes for the site name and number. The codes are found on the side of the filter housing and on the chain of custody label.

B.7.1.14 Open the mailing tube that contains this week's filter and a new SSRF.

B.7.1.15 Enter the date of the filter change, followed by the day of the week.

B.7.1.16 On the "Chain of Custody" label, enter your name and the date on the "Shipment Opened By" line.

B.7.1.17 Enter the filter pack number from the label on the filter pack housing.

B.7.1.18 Back outside, release the vacuum at the filter quick disconnect by pressing into the center of the connector until you hear a faint rush of air. Use a pen or small screwdriver.

B.7.1.19 Inspect and/or replace the Teflon® ozone inlet filter at this time if this is an NPS weekly station check. (Refer to Section B.3). Record in the site log book any filter change/ inspection activity.

B.7.1.20 Put on clean vinyl gloves and remove the caps from the new filter pack. Seal the caps in the Ziplock® bag and store the bag in the mailing tube until next week.

B.7.1.21 Install the filter pack by pressing it into the fitting until you hear a "snap", indicating a secure connection. Discard the gloves.

B.7.1.22 Raise the tower slowly and secure it by inserting the locking pin.

B.1.7.23 Reset the hour meter to zero. Turn the flow pump and hour meter on.

B.7.1.24 Enter the "Filter On" date and time on the new SSRF, using the Local Standard Time (LST) displayed by the datalogger "T" command.

B.7.1.25 "Up" the "O3" and "FLW" columns to bring them back on-line as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	U

UP COLUMN NUMBER?	___(for O3)<ENTER>
UP COLUMN NUMBER?	___(for FLW)<ENTER>
UP COLUMN NUMBER?	<ENTER>

Verify that the "O3" and "FLW" columns are on-line by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	A
VIEW WHICH COLUMNS?	___ ___(for O3 and FLW)<ENTER>
IN VOLTAGE OR ENGINEERING UNITS (V/E)?	E <ENTER>

The "D" to the right of the concentration under the O3 and FLW columns should be replaced with a "P" which should be absent within 5 minutes. If not, repeat the "Up" column procedure described in this section. On the O3 strip chart paper, write "O3 on-line" along with the time and date. Note in the Site Log Book when the channel was brought back on-line.

The <ESC> key will return the SumX data logger to the ">" prompt.

B.7.1.26 Read the rotameter and record the value on the new SSRF under the "Filter On" column.

B.7.1.27 After waiting 10 minutes, turn the echo on and enter an "H" command at the prompt. Record the latest datalogger flow value to the "DAS Flow" box.

B.7.1.28 Proceed to the "Site Observations" block on the SSRF. Circle the precipitation conditions present outside your shelter.

B.7.1.29 Observe the condition of the deciduous plants around the shelter. Mark the box that corresponds to the percentage of leaves that have dropped, the percentage of leaves that have fall color, and the percentage of leaves that are green. Look back at last week's form to make sure your findings make sense. This information is used to estimate the respiration rates of the local plants.

B.7.1.30 Store the SSRF, Ziplock® plastic bag, and caps in the mailing tube for completion next week.

Figure B.7.1-1. Example SSRF Form.

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Section	**B.8.1**
Title	**SCI-TEC BREWER SPECTROPHOTOMETER MODEL MKIV WITH PC DATA LOGGING AND CONTROL**
Effective Date	**OCTOBER 1997**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator	M. Tigges	
NPS COTR	J. McPartland	
NPS QA Officer	J. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

B.8.1 SCI-TEC BREWER SPECTROPHOTOMETER MODEL MKIV WITH PC DATA LOGGING AND CONTROL

PROCEDURES: WEEKLY

B.8.1.1 A weekly visit to a Brewer site includes many tasks that may also need to be performed daily or bi-monthly. The full procedure for each task will be presented in detail in weekly visit sections and will be referenced in the other sections. Perform the weekly site visit on Monday of each week and complete a Weekly Station Checklist. Blank checklists can be found in the pocket folder at the back of your SOP book. Note that the checklists are good for one month. Record the station name, operator name (first initial and full last name), the calendar date, and the Brewer number (see the metal plate affixed to the spectrophotometer housing) on the Weekly Station Checklist. An example Weekly Station Checklist is presented in Figure B.8.1.1-1.

B.8.1.2 Familiarize yourself with the graphic in Figure B.8.1.2-1 for locations of the power LEDs, the power switches, the UVB dome, and the quartz window before reading this section. Note the following on the Weekly Station Checklist.

- Current weather conditions (e.g., sunny, cloudy, precipitation, etc.)
- The orientation of the Brewer direct sun quartz window (it should be sunward).
- The power status by observing the green LEDs. One on the tracker and one on the spectrophotometer, should be illuminated.
- The status of the UV dome and quartz window (e.g., dust, snow, or other debris interfering with sunlight entering the UV dome or the quartz window).

Announce your presence at the site by signing in and recording your observations in the Brewer Operations LogBook. It is important to log activities that affect data validity. See Figure B.8.1.2-2 for an example of a properly annotated logbook page.

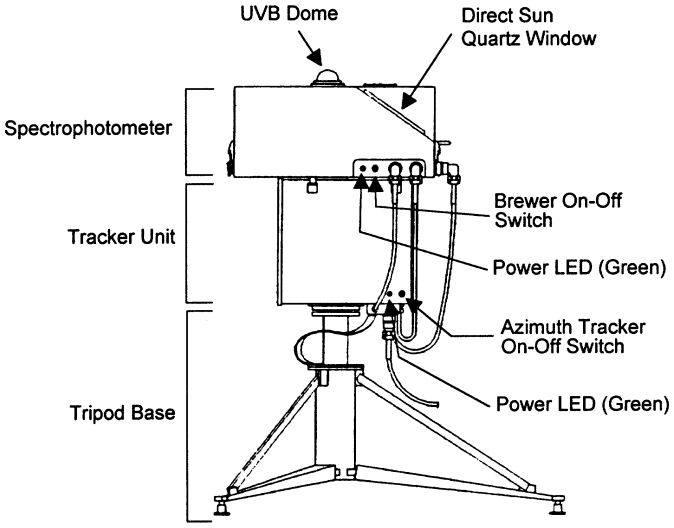


Figure B.8.1.2-1. Brewer Spectrophotometer Tracker Power Switch and Indicator Locations.

STATION: Badlands National Park

WEEKLY STATION CHECKLIST

SECTION B.8.1 SCI-TEC BREWER SPECTROPHOTOMETER MODEL MKIV

RECORD THE FOLLOWING:		VISIT 1	VISIT 2	VISIT 3	VISIT 4	VISIT 5
B.8.1.1	SITE OPERATOR	*J. Smith*				
	CALENDAR DATE	*10/24/97*				
	BREWER NUMBER	*134*				
B.8.1.2	NOTE WEATHER OBSERVATIONS IN LOGBOOK? (Y/N)	*Yes*				
	BREWER ORIENTED TOWARDS SUN? (Y/N)	*Yes*				
	POWER ON TO SPECTROPHOTOMETER & TRACKER? (Y/N)	*Yes*				
(Y/N)	UV DOME & DIRECTION QUARTZ WINDOW CLEAN?	*Yes*				
B.8.1.3	MONITOR FOUND IN SCHEDULE MODE? (Y/N)	*Yes*				
B.8.1.5	MONITOR DISPLAYING CORRECT DATE? (Y/N)	*Yes*				
B.8.1.6	MONITOR DISPLAYING CORRECT TIME? (Y/N)	*Yes*				
B.8.1.9	SCHEDULE CORRECT? (EPA96) (Y/N)	*Yes*				
B.8.1.10	WAS THE UV DOME OR QUARTZ WINDOW CLEANED (Y/N)?	*No*				
B.8.1.11	HUMIDITY INDICATOR OK (Blue or Pink)?	*Blue*				
B.8.1.13	RECORD “sr” TEST RESULT.	*14660*				
	WITHIN LIMITS?* (Y/N)	*Yes*				
B.8.1.16	WAS A TRACKER LEVEL TEST PERFORMED? (Y/N)	*Yes*				
B.8.1.17	“si” TEST OK? (Y/N)	*Yes*				
	ALIGNMENT ADJUSTED? (Y/N)	*No*				
B.8.1.20	COMMENTS LOGGED ON COMPUTER? (Y/N)?	*Yes*				
B.8.1.21	SCHEDULE RE-STARTED (EPA96)? (Y/N)	*Yes*				
B.8.1.22	STATION SUPPLY CHECKLIST COMPLETED? (Y/N)	*Yes*				

* If values are not within acceptable ranges, notify the OSC.

Figure B.8.1.1-1 Example Weekly Station Checklist

Brewer # *134* Page *164*

Station *Badlands* Operator *J. Smith*

U.S. National UV Monitoring Station Log

Date	Time	Action	Operator
		[ ] Continued from previous page	*J.S.*
9/19/97	*1945*	*J. Smith entered the station to perform a weekly Brewer UVB site visit. The Brewer appears to be oriented towards the sun and operating correctly. The UV Dome and quartz window have light dust on them.*	
	1957	*Clear and cool today, light winds out of the north. The monitor time and date are correct. Computer is in schedule mode.*	
	2001	*Cleaned the UV Dome and the quartz window and checked the desiccant conditions.*	
	2013	*Took the computer out of the schedule mode for Brewer performance checks.*	
	2035	*Performed sr test successfully, results of 14654 compared to a theoretical of 14658. No action necessary.*	
	2041	*Performed si test. A very small clockwise adjustment was made to the azimuth. Called the monitoring operations support contractor to report the small adjustment. The technician said to call if another adjustment was necessary next week.*	
	2102	*Left a short message on the computer describing the day's events.*	
	2110	*Put the computer back in schedule mode.*	
	2112	*Checked the station supply list. Need more Kimwipes, will call operations support from the office.*	
	2120	*Checked to make sure that the Brewer is operational. J. Smith exiting station.*	

Figure B.8.1.2-2 Example Logbook Entry.

B.8.1.3 In the station, the computer, monitor, and printer should be on. Due to the variety of tasks the spectrophotometer performs, the monitor will display several different variations of the graphic in Figure B.8.1.3-1.

Familiarize yourself with the graphic as you read through the list of parameters below. The monitor screen should have the following information:

- **Month**
- **Day**
- **Year**
- **Julian Day**
- **Mode of Operation (O3 or N2)** - The Brewer spectrophotometer program is made of a series of measurement cycles. Each mode is designed to measure a certain parameter and has multiple settings particular to that parameter.
- **Brewer Number** - Each Brewer has a serial number associated with it inscribed on a metal plate on the spectro-photometer cover.
- **Location -** The site should have been named during installation.
- **Internal/External Clock, (I or E)** - "I" indicates the Brewer is using the internal clock or the Brewer clock. "I" is the preferred setting. "E" indicates the Brewer is using the external clock or the PC clock.
- **Coordinated Universal Time (CUT)** - Previously called Greenwich Mean Time (see Section B.8.1.6).
- **Measurement in Progress (ds, zs, or uvb)**
- **Schedule Running ("epa96" unless instructed otherwise)** - The schedule is the file that controls the measurement mode and processes and stores the data. The schedule and GWBasic program are stored on the PC hard drive.
- **Free Disk Memory** - Free memory left on the PC hard drive.
- **Solar Zenith Angle.**
- **RS232 Activity Indicator** - The asterisk flashes when communication is occurring between the Brewer and the PC.
- **Current Brewer Activity Indicator.**
- **Current Data Summary** - In each mode, a particular type of data are collected. This part of the monitor is reserved to display a current data summary.

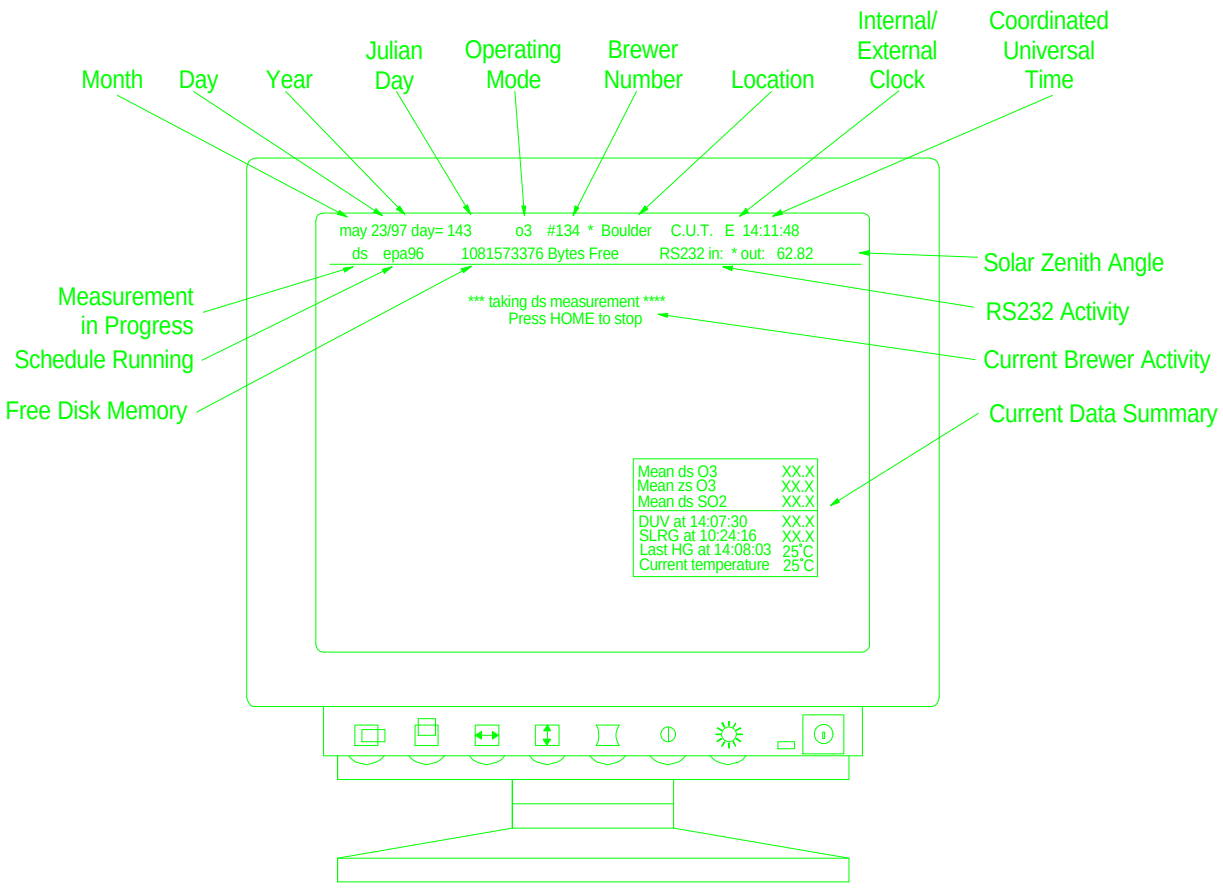


Figure B.8.1.3-1. Illustration of a Typical Screen in Schedule Mode.

B.8.1.4 Corrections to errors that are encountered occasionally on the PC monitor can be accomplished by first pressing the <HOME> key and waiting for the PC to display the Main Menu. The <HOME> key interrupts the schedule and returns control of the Brewer to the Main Menu. All commands can be entered from this menu, although not all choices are displayed. See the operator's manual for a complete listing of commands.

It is important to log activities that affect data validity in the Brewer Operations Logbook including a brief review of the visit on the PC using the "cm" command. The data processing contractor can download the data and comments via the built-in modem every night. See section B.8.1.20 for details on using the "cm" command.

B.8.1.5 Compare the calendar date and the Julian day with that found on the monitor screen. A Julian day calendar can be found

on

the salmon colored card in the front of the SOP book. Corrections to the calendar date and Julian day, if necessary, are made using the "da" command, as follows:

Keyboard Action	**Monitor Display**
Press the <HOME> key. (Wait several seconds for the Main Menu to appear).	
Enter "da" on the command line.	*DATE: -(C.U.T.)-may 28/97* *If correct press return.*
Enter the two digit day of the month.	*If incorrect enter new date.* *-- Day - DD*
Enter the two digit month.	*-- MONTH -MM*
Enter the last two digits of the year (the program returns to the Main Menu).	*-- YEAR -YY*

B.8.1.6 Compare the Brewer time against the digital clock in your station set to Coordinated Universal Time, or CUT. The station clock should be checked against the atomic clock in Boulder, Colorado, once a month, to assure that it is within 10 seconds of CUT. The telephone number to obtain the CUT is 303-499-7111. A recording will announce the CUT at the top of every minute. Enter the CUT exactly as it is read to you from Boulder, regardless of your time zone.

If the Brewer clock is using the computer clock, the upper right of the display will indicate this with an "E" for "external". An "I" indicates that the Brewer is using its own internal clock. The preferred setting is "I". If "E" is displayed, use Method A below to correct both the time and the external clock setting. If an "I" is displayed, use Method B below to correct only the time. It may occasionally be necessary to change the external time, "E", before changing the Brewer clock back to internal time, "I". Use Method C for this occasion.

METHOD A

Keyboard Action	**Monitor Display**
Press the <HOME> key. (Wait several seconds for the Main Menu to appear).	
Enter "ti" on the command line.	*Brewer clock is off.* *Do you want it turned back on?*
Enter a "Y" for yes.	
Enter CUT here.	**** time=14:38:02*
Press <ENTER>. (The program returns to the Main Menu).	*If correct press return.*

Make the appropriate entry into the Brewer Operations Logbook.

METHOD B

Keyboard Action	**Monitor Display**
Press the "HOME" key. (Wait several seconds for the Main Menu to appear).	
Enter "ti" on the command line.	**** time=14:38:02*
Enter CUT here.	*If correct press return.*
Press <ENTER>. (The program returns to the Main Menu).	

Make the appropriate entry into the Brewer Operations Logbook.

METHOD C

Keyboard Action	**Monitor Display**
Press the <HOME> key. (Wait several seconds for the Main Menu to appear).	
Enter "ti" on the command line.	*Brewer clock is off. Do you want it turned back on?*
Enter a "N" for no.	
Enter CUT here.	**** time=14:38:02*
	If correct press return.
Press <ENTER>. (The program returns to the Main Menu).	

Make the appropriate entry into the Brewer Operations Logbook.

B.8.1.7 The Brewer number is inscribed on a metal plate attached to the spectrophotometer. Corrections to the Brewer number can be made by using the "no" command, as follows:

Keyboard Action	**Monitor Display**
Press the <HOME> key. (Wait several seconds for the Main Menu to appear).	
Enter "no" on the command line.	*Instrument #= 134*
	If correct press return.
	If incorrect enter the proper value.
Enter the new Brewer Number. (The program returns to the Main Menu).	

B.8.1.8 Your station location is included on a list presented on the monitor when the "ll" command is entered. Corrections to your station's location can be made by entering the "ll" command, as follows:

Keyboard Action	**Monitor Display**
Press the <HOME> key. (Wait several seconds for the Main Menu to appear).	
Enter "ll" on the command line.	*1 Site Name 1.* *2 Site Name 2.* *3 etc.* . . . *X Site Name X.* *n if not coded above*

Enter the number of your site and press Enter.

B.8.1.9 All operations are controlled by individual commands within a program called a schedule. The "skc" command allows the user to load and enter a schedule via the keyboard. The Brewer will then begin taking measurements and collecting data. The Brewer should be in schedule mode upon entering and leaving the station. The schedule for NPS monitoring is currently epa96.skd. Set the schedule as follows:

Keyboard Action	**Monitor Display**
Press the <HOME> key. (Wait several seconds for the Main Menu to appear).	
Enter "skc"	*C:\BREWER* *EPA1.SKD……EPA96.SKD* *XXXXXXXXXXXX Bytes Free* *Enter schedule name (no extension).*

Enter "epa96"

Confirm that the schedule is running. The code, "epa96" will appear in the schedule running window on the monitor. Refer back to Figure B.8.1.3-1.

B.8.1.10 Before cleaning the UV dome and the quartz window, make notes in the Brewer Operations Logbook describing the condition of the dome and quartz window (e.g., Snow, dust, etc.). Use deionized water (or isopropyl alcohol in the winter) on the dome and quartz window and clean gently with a Kimwipe®. Examine the optical surfaces from several different angles watching for debris on the optics, and repeat the cleaning process until satisfactory.

B.8.1.11 Check the condition of the humidity indicator visible beneath the quartz window. The indicator is a card coated

with a moisture-sensitive emulsion that is blue when the desiccant is in good condition, and turns pink when the desiccant has been exhausted.

If the indicator is pink, the internal desiccant package must be replaced. In good weather, with no high winds or precipitation, remove the white Brewer cover by turning each of the four latches one-half turn counterclockwise and lifting the cover off. Store the cover, avoiding scuffing the UV dome and quartz window. The desiccant package is located in the right rear corner of the Brewer enclosure as viewed from the quartz window side of the Brewer. Removing the black spectrophotometer cover should be done only under instructions from the Operations Support Contractor (OSC). **Do not attempt to clean the mirrors.**

B.8.1.12 After replacing the desiccant package in the Brewer, replace the white cover and engage the latches by turning them one-half turn clockwise. The desiccant can be reactivated by heating the bag in an oven for at least 24 hours at a temperature of about 150°F. Seal the reconditioned desiccant in Ziplock® bags until used.

B.8.1.13 Perform a **tracker steps per revolution test,** initiated with the "sr" command. Proceed with the **tracker steps per revolution test** only if the Brewer is not performing a UV scan. Check the "Measurement in Progress" entry on the monitor for the measurement cycle status (refer back to Figure B.8.1.3-1). A UV scan is indicated by a "ux" in the Measurement in Progress entry. If necessary, wait for the UV scan to finish, usually just a few minutes, then press the <HOME> key to interrupt the schedule. The <HOME> key will return the computer monitor to the Main Menu. Enter a "PNSR" command, which will toggle the printer on-line and begin an "SR" test on the tracker. The tracker "zeros" its azimuth and then measures the total number of steps in one revolution.

B.8.1.14 The Main Menu will reappear when the **tracker steps per revolution test** is complete. Remove the printout and compare the steps/revolution value to the original steps/revolution value in the Final Test Record accompanying your Brewer. The number should be approximately 14660. Record the steps/revolution value in the Brewer Operations Log. If the indicated number and the original value differ by more than $\pm$20 steps, it may indicate the friction wheel is slipping and needs to be cleaned. Familiarize yourself with the graphic in Figure B.8.1.14-1 before reading further. Notify the OSC before proceeding further.

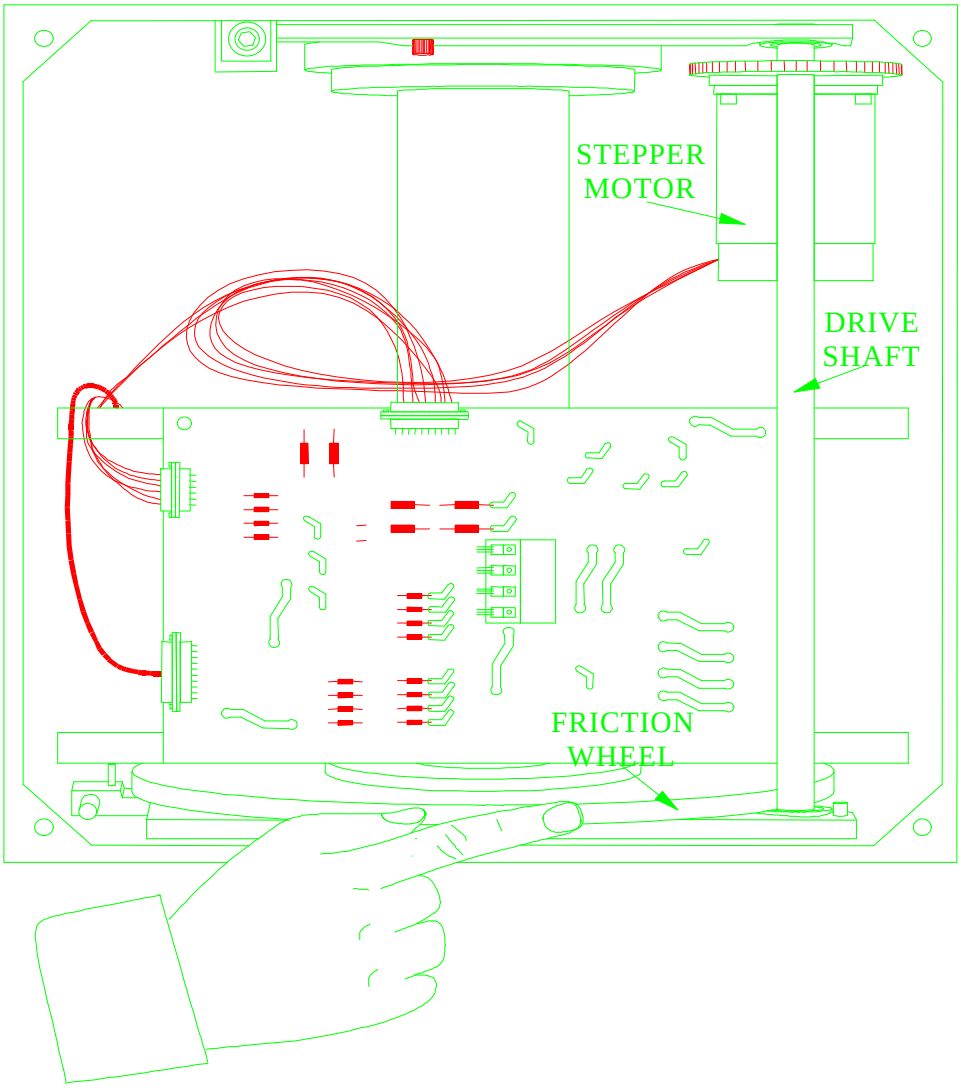


Figure B.8.1.14-1. Friction Wheel Location.

B.8.1.15 The friction wheel can be cleaned by opening the tracker cover opposite the quartz window side of the Brewer. Remove the four hex-head screws with a hex key driver supplied with your Brewer. Wipe the edge of the large friction wheel with a Kimwipe® and isopropyl alcohol while rotating it manually. Run “SR” again after cleaning until the same value can be repeated three times, then save the new value when prompted.

Record all activities and new steps/revolution value in the Brewer Operations Logbook.

B.8.1.16 The **tracker level test** is performed whenever there is reason to believe that the Brewer platform level has changed or has been compromised. Perform this test with the tracker power off and the Brewer is not running a schedule. In this condition the Brewer may be manually turned through one revolution.

Place the carpenter's level, which was supplied with the Brewer, on top of the Brewer case. Note the position of the level bubble. The bubble does not necessarily indicate that the Brewer case is level, this test challenges only the tracking mechanism. Observe the level bubble as you rotate the Brewer and note that the bubble does not change position. If the level bubble changes position during the rotation, call the OSC. Return the Brewer to the original position so that the ground strap does not wrap around the tracker post. Turn on the tracker power.

B.8.1.17 Perform a **solar alignment test** using the "si" command. Entering a "prsi" points the azimuth tracker and the zenith prism to the sun based on the correct day and time (CUT) and Brewer location (latitude and longitude) and sends results of the test to the printer. See Figures B.8.1.17-1 and B.8.1.17-2 to become familiar with the expected images and adjustment button locations. Look through the entrance-slit viewport to make sure that the Sun's image is centered on the slit. The sky must be reasonably clear for this test. The sun's image enters the Brewer through the quartz window. Take precautions not to block the quartz window with your shoulder as you peer into the viewport.

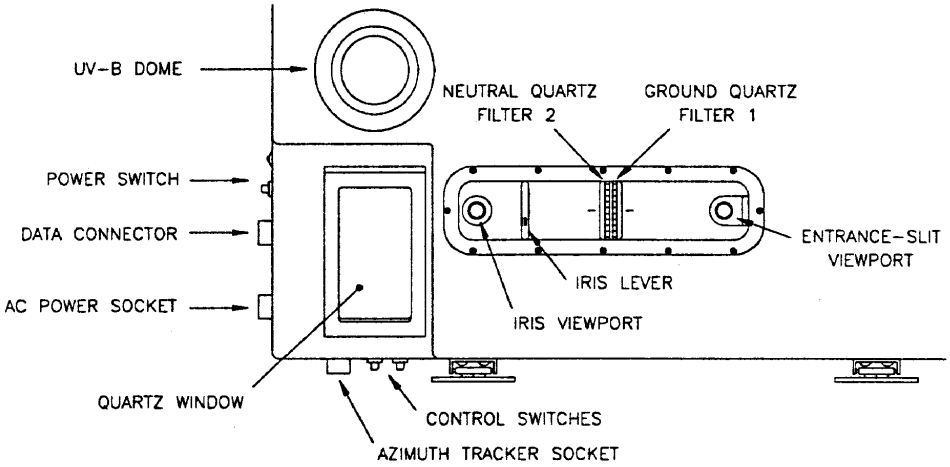
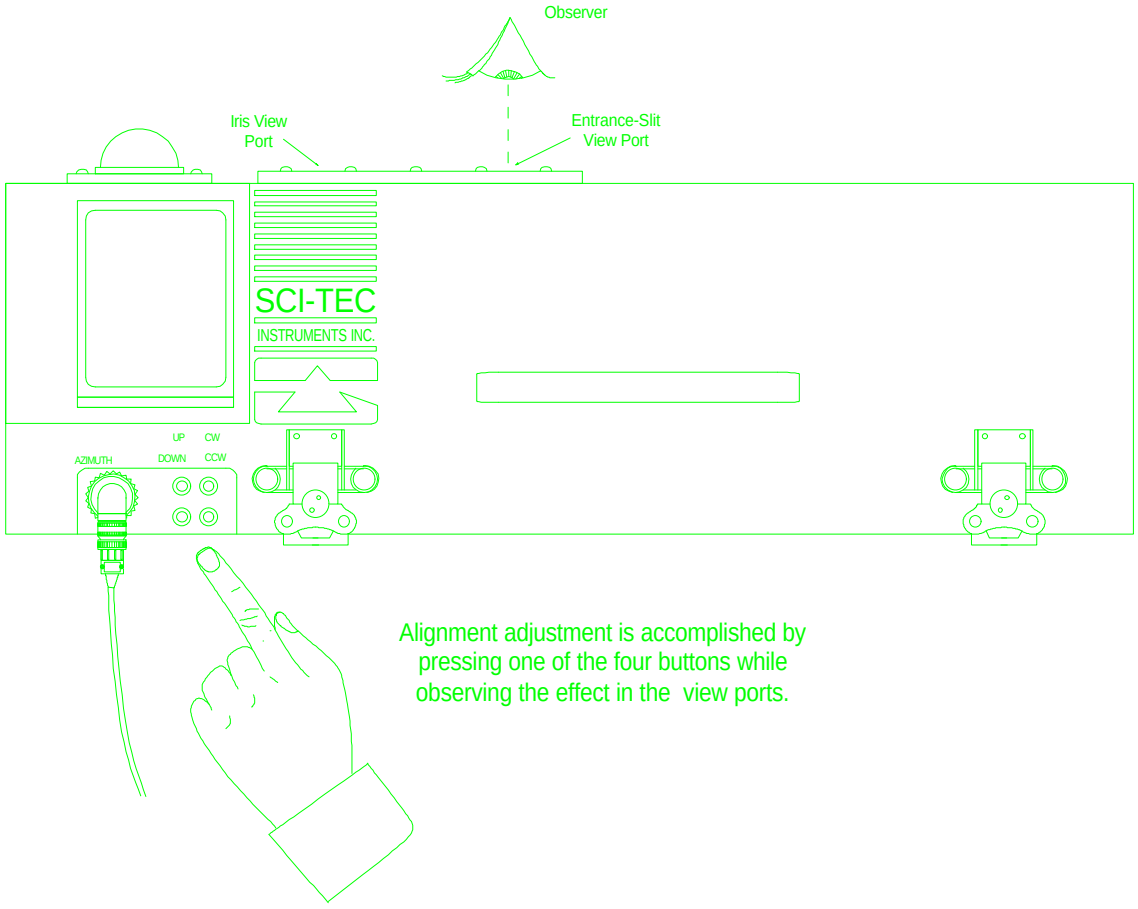


Figure B.8.1.17-1. Brewer Viewport Locations.

B.8.1.18 If the sun is not centered in the slit, use the four buttons on the Brewer body to adjust it to be so. The CW button rotates the tracker clockwise, and CCW button rotates the tracker counterclockwise. UP and DOWN buttons move the zenith prism in the respective directions. The adjustment motions are very small; a button may have to be pressed for up to 20 seconds to observe the direction of the correction.

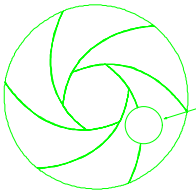
There is a 1 to 2 second delay of movement after a button has been depressed and there will be 1 or 2 seconds of movement after the button is released.



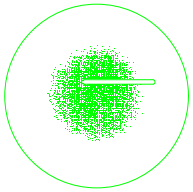
Alignment adjustment is accomplished by pressing one of the four buttons while observing the effect in the view ports.

The View from the Iris View Port

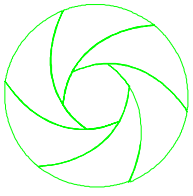
The View from the Entrance-Slit View Port



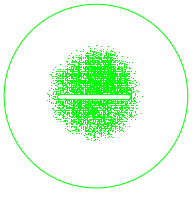
Poorly aligned Brewer has a solar image on the iris instead of in the center.



Inproperly aligned Brewer with the slit not centered on the diffused solar image.



Properly aligned Brewer shows no solar image since it passes through the center.



Properly aligned Brewer with slit centered on the diffused solar image.

Figure B.8.1.17-2. Brewer Spectrophotometer Solar Alignment Adjustment.

B.8.1.19 If the sun's image can not be seen in the entrance-slit view port, the Brewer may be very poorly aligned and alignment must first be performed using the iris view port. Look through the iris view port. If the solar image can be seen on the iris, alignment must first be made to center the solar image in the iris hole. The procedure for centering the sun's image in the iris hole is the same as the procedure for centering the sun's image on the slit. The CW button rotates the tracker clockwise and the CCW button rotates the tracker counterclockwise. UP and DOWN buttons move the zenith prism in the respective directions.

When the iris is centered, check the entrance-slit view port and complete the slit centering. When this is done, enter <CTRL> + <END> to get out of the sighting, "si", mode, and press "Y" to save the new setting. Under normal conditions, the azimuth setting doesn't change by more than 10 steps and the zenith setting by more than 4 steps. Record the zenith and azimuth correction steps in the Brewer Operations Logbook. The Main Menu is displayed when the test is complete.

B.8.1.20 Before exiting the station and re-starting the schedule, briefly summarize the events of the site visit on the computer. These comments are saved to a time-tagged file and downloaded by the data processing contractor nightly. Begin by entering a "cm" on the command line. Type your comments in the space provided. The contents should resemble the logbook entry for the visit. Press <escape> to save the message to the computer hard drive.

B.8.1.21 Re-start the schedule, epa96, by typing "skc" then <ENTER> and then "epa96" (without the extension ".SKD") and <ENTER>. The schedule will appear on the monitor in the "Schedule Running" location (refer to Figure B.8.1.3-1).

B.8.1.22 Complete the Station Supply Checklist (Kimwipes®, window cleaner, isopropyl alcohol, desiccant packages, logbook pages, and lamp log pages.)

B.8.1.23 The status of the Brewer can be ascertained remotely by using the communications software package, CLOSE-UP, supplied with your Brewer. Follow the instructions that come with the software and install the program on a convenient computer with a modem and a telephone line. Initialize the software with the site's telephone number. Call the site through the program. Once the on-site modem has answered and connection has been established, press <enter> several times until the computer monitor displays the image of the Brewer computer monitor screen. All commands entered from the keyboard behave similar to those entered on site. Remember to re-start the schedule if necessary.

PROCEDURES: DAILY

B.8.1.24 The Brewer requires some procedures to be performed daily, or at least three times per week.

B.8.1.25 Before cleaning the optics, make notes in the Brewer Operations Logbook, describing the condition of the dome and quartz window. Apply isopropyl alcohol on the dome and quartz window and clean it off gently with a Kimwipe®. Examine the optical surfaces from several different angles watching for debris on the quartz. Repeat the process until satisfactory.

B.8.1.26 The computer monitor should have the following information:

- **Month**
- **Day**
- **Year**
- **Julian Date**
- **Brewer Mode (O3 or N2)**
- **Brewer Number** - Each Brewer has an associated number.
- **Location** - The site should have been named during installation.
- **Coordinated Universal Time** - See Section B.8.1.6.
- **Measurement in Progress (ds, zs, uvb, etc.)**
- **Schedule Running** - "epa96" unless instructed otherwise.
- **Free Disk Memory** - Free memory left on the PC hard drive.
- **Solar Zenith Angle**
- **RS232 Activity Indicator** - The asterisk flashes when communication is occurring between the Brewer and the PC.
- **Current Brewer Activity Indicator**
- **Current Data Summary**

Refer to Figure B.8.1.3-1 for an illustration of a typical screen in schedule mode.

B.8.1.27 Corrections to errors on the monitor screen can be made by first pressing the <HOME> key and waiting for the PC to display the Main Menu.

See Section B.8.1.4 through B.8.1.9 for details of corrective actions. Make an entry in the logbook noting any error conditions and your progress in correcting the problem(s).

B.8.1.28 In the event that a visit cannot be arranged, the status of the Brewer can be ascertained remotely by using the communications software package, CLOSE-UP, supplied with your Brewer. Follow the instructions that come with the software and install the program on a convenient computer with a modem and a telephone line. Initialize the software with the site's telephone number. Call the site through the program. Once the on-site modem has answered and connection has been established, press enter several times until the computer monitor displays the image of the Brewer computer monitor screen. All commands entered from the keyboard behave similar to those entered on site. Remember to re-

start the schedule if necessary.

B.8.1.29 At least three visits to clean the UV dome and quartz window should be made in addition to the weekly visit. If the primary operator's hours cannot cover the time necessary to perform this duty, arrangements can often be made with others in the park unit who have access to the area. Cleaning the exterior optics is important to the monitoring effort and takes only a few minutes.

PROCEDURES: BI-MONTHLY (EXTERNAL LAMP CALIBRATION)

B.8.1.30 On the first and third Monday of each month, the Brewer Spectrophotometer should be calibrated using the external lamp calibration assembly in the black plastic box supplied with your spectrophotometer. Postpone the calibration during wet or windy weather until the next good weather day.

B.8.1.31 Contents of the external lamp calibration kit include: Five individually numbered 50W/12VDC halogen lamps, a multimeter, cabling, and a lamp calibration housing and power supply built into the black box. See the labeled diagram in Figure B.8.1.31-1.

B.8.1.32 The lamp log form is used to track the performance of the Five external calibration lamps. Locate the forms in the back of the Brewer Operations Logbook in preparation for the calibration check. Since weather can affect calibration results, enter the current weather conditions, such as temperature, winds, and precipitation, on the Lamp Log Form.

Note: If a UV scan is in progress, wait until it is finished before interrupting the program. The calibration lamp assembly may be setup on the Brewer at this time. Otherwise, press the <HOME> key to interrupt the Brewer schedule and return control to the Main Menu screen.

B.8.1.33 Choose three lamps to be used in the calibration, rotating the five lamps to use each lamp equally. The Lamp Log Form is useful in establishing a record and a rotation pattern for each lamp. Take a Brewer 50W/12V halogen lamp out of the black case. Take extreme care not to touch the lamp itself with your fingers or allow the lamps to come into contact with any wet or dirty materials, as it can reduce the operational lifetime. Enter the three digit lamp number, found on the bottom of the lamp, on the Lamp Log Form.

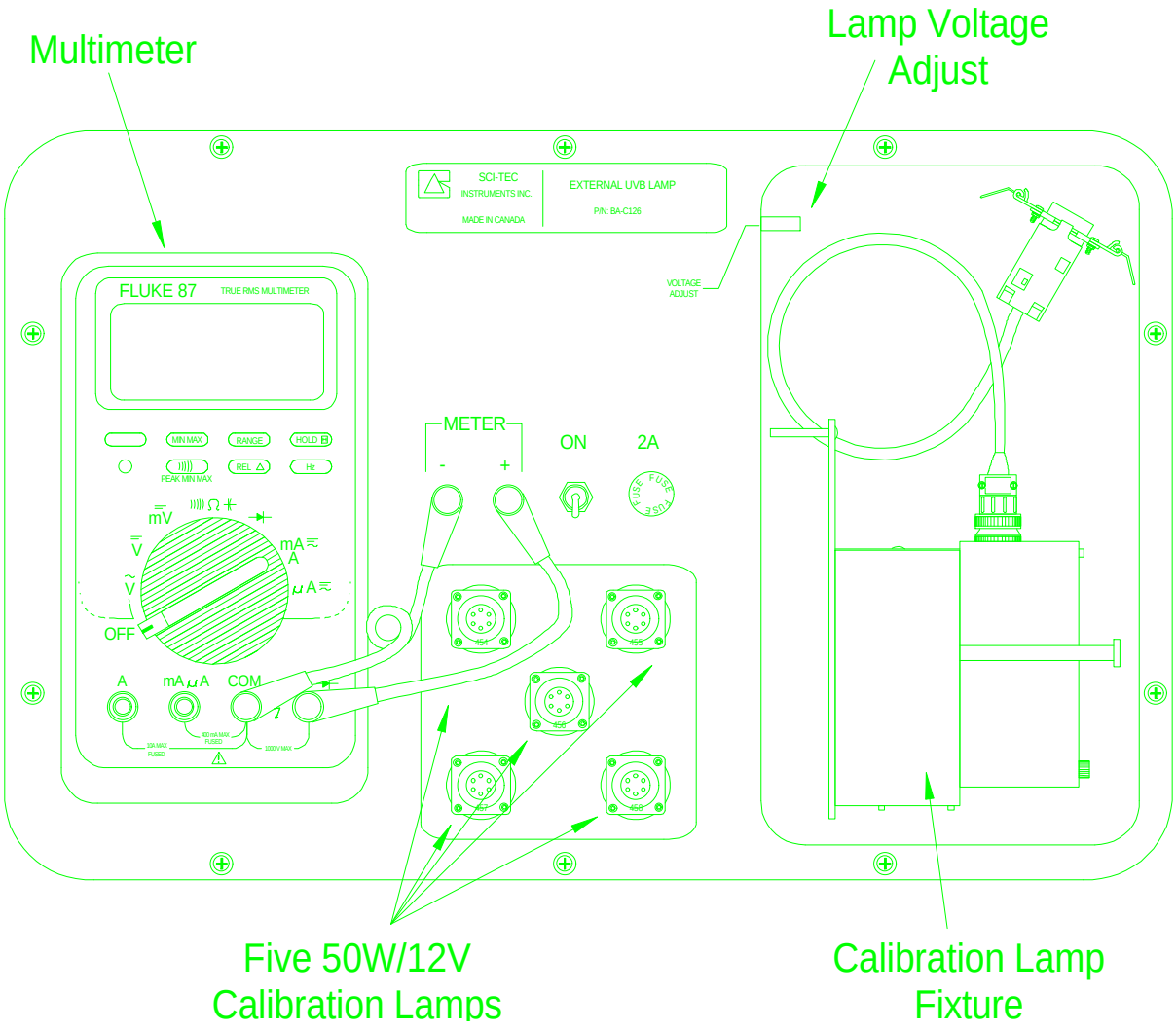


Figure B.8.1.31-1. External Calibration Lamp Kit

B.8.1.34 Familiarize yourself with the graphic in Figure B.8.1.34-1 before performing the tasks listed in this section. Carefully remove the two pieces of packing foam from the lamp and store them back in the black case. Check the filament alignment by looking through the side holes of the lamp housing at the filament. The holes should line up with the filament coil as seen in Figure B.8.1.34-1. If misalignment is severe, gently adjust the lamp position by pushing it with a Kimwipe® until the coil is aligned with the sighting holes.

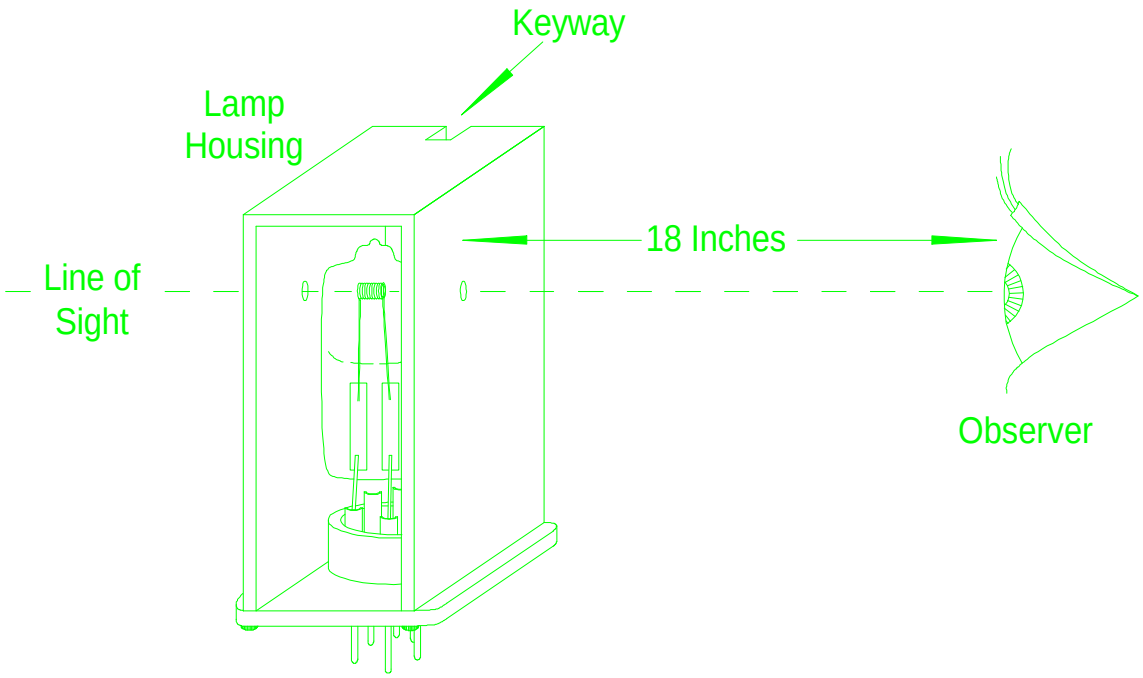


Figure B.8.1.34-1. Calibration Lamp Filament Coil Alignment Method.

B.8.1.35 Ensure that the UVB dome is clean. This may be achieved by using a Kimwipe® and deionized water or isopropyl alcohol.

B.8.1.36 Familiarize yourself with the graphic in Figure B.8.1.36-1. Slide the fixture cover off the fixture by loosening the thumbscrew on the cover. Insert the first lamp firmly into the calibration fixture socket. A pin on the base of the calibration fixture will line up with a keyway in the lamp housing preventing the lamp from being installed upside down. Slide the fixture cover on and tighten the thumbscrew on the cover into the fixture threads. Place the entire assembly on the top of Brewer UVB Dome with the two nylon legs firmly against the brewer case.

CAUTION: These lamps emit UV radiation which can be harmful to your eyes! Always ensure that the lamp cover is in place before turning the power on. THE LAMP AND CALIBRATION HOUSING WILL BECOME EXTREMELY HOT.

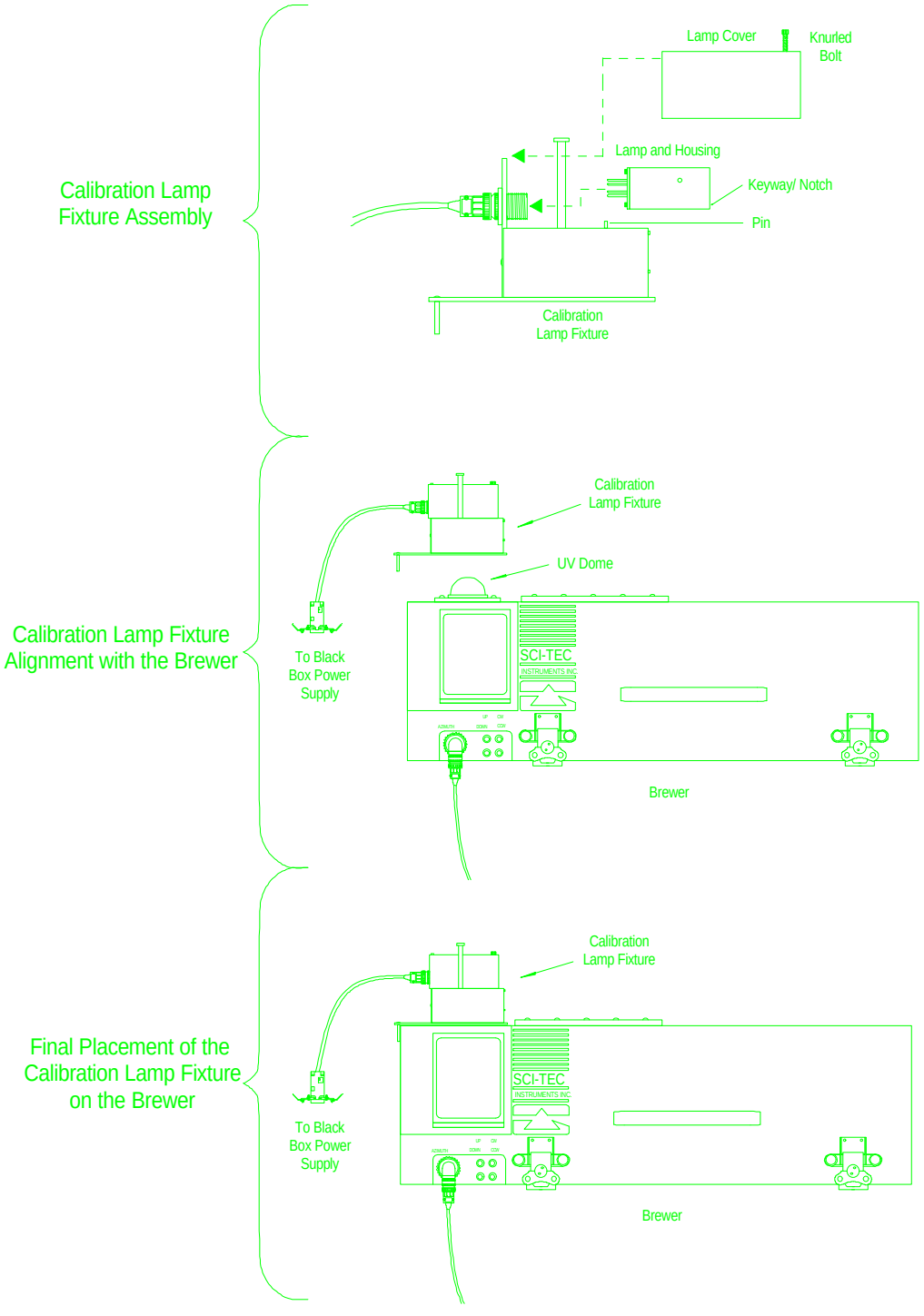


Figure B.8.1.36-1. Calibration Lamp Fixture Assembly and Placement on Brewer.

B.8.1.37 Plug the lamp cord into the lamp power supply using the nine-pin connector and plug the power cord into the power outlet under the tracker. Turn on the power to the external lamp calibration kit by toggling the switch inside the black case to the "ON" position. Switch on the multimeter to the VDC setting (two clicks clockwise on the selector switch), while holding the yellow button down for two or three seconds. The meter should display a three decimal point output. (If the yellow button is not depressed while turning on the multimeter, it displays a two decimal point output.) Using the voltage adjust knob in the black case, adjust the voltage to 12.000 ±0.005 volts. Let the lamp warm up for approximately 10 minutes and adjust the voltage to 12.000 ±0.005 volts as necessary. **This voltage must be maintained throughout the calibration.**

B.8.1.38 When the lamp warmup is complete, enter "pnhgxlqs" on the command line. Enter the lamp number, then accept the default distance 5 cm when prompted for both on the monitor. The command string performs the following separate commands in sequence.

B.8.1.39 **"PN" - Sends results to the printer.** The printer is toggled on-line to record the results of the calibration.

B.8.1.40 **"HG" - Mercury Wavelength Calibration.** It takes 5 minutes to warm up and approximately 2-3 minutes to scan.

B.8.1.41 **"XL" - Standard Lamp Scan.** This takes approximately 20 minutes. Check the digital multimeter a few times during the scan to ensure constant voltage of 12.000 ±0.005 VDC is maintained by adjusting the value using the knob on the inside of the black box labeled "adjustment."

B.8.1.42 **"QS" - Quick Lamp Scan.** The "quick scan" printout lists the following:

- Time, CUT in decimal hours. (Example: 14:30:00 in hours:minutes:seconds format is 14.500 in decimal hours format).
- The measurement wavelength, in nanometers.
- Position of the spectrometer micrometer from zero, in number of steps.
- The intensity of the reading.
- The percent change from the stored initial measurement.

Remove the printout and transcribe the percent change for the lamp next to the lamp serial number on the Lamp Log Form and on the PC using the “cm” command. Estimate the “lamp on time” and enter it as well.

B.8.1.43 Repeat procedures B.8.1.30 through B.8.1.34 for the second and third lamps.

CAUTION: THE LAMP AND CALIBRATION HOUSING WILL BE EXTREMELY HOT FOR SEVERAL MINUTES AFTER POWER IS OFF. WAIT UNTIL THE LAMP IS COOLED BEFORE REMOVING.

B.8.1.44 Finally, put the Brewer back to its scheduled operation. Remove the calibration lamp fixture from the UVB dome. Enter "skc" then enter "epa96" on the keyboard (without the ".skd" extension). unless instructed to do otherwise. For example:

Keyboard Action	**Monitor Display**
Enter "skc"	*C:\BREWER* *EPA1.SKD……EPA96.SKD* *XXXXXXXXXXXX Bytes Free* *Enter schedule name (no extension).*
Enter "epa96"	

B.8.1.45 In the event that the percentage difference for one or both of the lamps is greater than 5%, the Brewer response function may have changed. Call the OSC for instructions. Enter all activities in the Brewer Operations Logbook and enter a brief summary of the calibration activities on the PC using the "cm" command.

B.8.1.46 In the event that a visit cannot be arranged, the status of the Brewer can be ascertained remotely by using the communications software package, CLOSE-UP, supplied with your Brewer. Follow the instructions that come with the software and install the program on a convenient computer with a modem and a telephone line. Initialize the software with the site's telephone number. Call the site through the program. Once the on-site modem has answered and connection has been established, press <enter> several times until the computer monitor displays the image of the Brewer computer monitor screen. All commands entered from the keyboard behave similar to those entered on site. Remember to re-start the schedule if necessary.

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**C**
Title	**STATION CONFIGURATIONS**
Effective Date	**JUNE 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

SECTION C STATION CONFIGURATION

An overall understanding of how a station works helps the station operator communicate more effectively with monitoring support personnel, diagnose problems with equipment, and resolve problems efficiently. Drawings of station configurations and instruments have been included at the end of this section to assist the operator in understanding and troubleshooting. Each station has a SumX SX445 Data Acquisition System (DAS), most stations have an ambient air intake manifold, and all stations have an ozone analyzer and a transfer standard with varied configurations. Figure C-1 diagrams the signal wire configuration present at most NPS air quality stations. All signals must pass through the Signal Interconnect Panel (SIP) before being recorded by the DAS and strip chart recorder.

C.1 SUMX SX445 DATA ACQUISITION SYSTEM

The SumX SX445 Data Acquisition System (DAS) collects, processes, and stores ozone, meteorological, and system parameter data. It also controls calibration events and flags data for validation. Figure C-2, Rear View of SumX SX445 Data Acquisition System, provides a drawing of the rear view of a SumX data logger and the associated signal input and control output ports.

C.2 INTAKE/EXHAUST MANIFOLD

The ambient air intake manifold continuously draws air from the teflon-coated green inlet hat, through the glass manifold, into the exhaust manifold, through the fan and out the shelter wall. Figure C-3, Sample Intake/Exhaust Manifold Diagram, illustrates the parts that comprise the intake manifold.

C.3 ANALYZER FILTER HOLDERS

Particulate filters are used for all air quality analyzers in the NPS air quality network. They prevent dust particles, insects and other debris from entering the analyzer and collecting on the analyzer's optical surfaces. The filters are changed when visible dirt is detected on them, typically every one to two weeks, depending on station location and climatic season.

Two types of filter holders are used in the network. Both are shown in Figure C-4, Analyzer Filter Holders. Although different in appearance and servicing technique, they both accept the same filter element. Both filters are designed to accept air flow in one direction only. The direction is clearly indicated on each filter holder case. Take care to maintain the correct filter orientation. The arrow should always point in the direction of air flow (towards its analyzer).

C.4 OZONE MONITORING INSTRUMENTS

The analyzer and in-station transfer standard configurations vary across the NPS air quality monitoring network. Table C-1, Equipment at NPS Air Quality Monitoring Stations, presents the equipment located at each station.

One of the following figures will illustrate, or closely approximate, the configuration type at your station:

C.4.1 Dasibi-Dasibi Type Station

Figure C-5 NPS Ambient Ozone Monitoring Configuration for Dasibi-Dasibi Type Station

Figure C-6 Close-up Illustration of Dasibi-Dasibi Front Panels

C.4.2 Dasibi-CSI Type Station

Figure C-7 NPS Ambient Ozone Monitoring Configuration for Dasibi-CSI Type Configuration

Figure C-8 Close-up Illustration of a CSI Ozone Analyzer Front Panel

C.4.3 Dasibi-Monitor Labs Type Station

Figure C-9 NPS Ambient Ozone Monitoring Configuration for Dasibi-Monitor Labs Type Station

C.4.4 Monitor Labs Type Station

Figure C-10 NPS Ambient Ozone Monitoring Configuration for Monitor Labs Type Station

Figure C-11 Close-up Illustration of ML 8550 and ML 8810 Front Panels

C.4.5 Dasibi-API Type Station

Figure C-12 NPS Ambient Ozone Monitoring Configuration for Dasibi-API Type Station

Figure C-13 Close-up Illustration of an API Analyzer Front Panel

C.4.6 Monitor Labs-Dasibi-Dasibi Type Station

Figure C-14 NPS Ambient Ozone Monitoring Configuration for Monitor Labs-Dasibi-Dasibi Type Station

C.5 SERVICE BULLETINS

Some equipment malfunctions can be successfully repaired by the station operator. The drawings found in this section will guide the replacement of commonly replaced components. The OSC will direct these activities.

C.5.1 Electrometer Board Replacement in a Dasibi Ozone Analyzer

Any site with a Dasibi ozone instrument (1003-PC, 1003-RS, or 1003-AH) may use the directions for electrometer board replacement in Figure C-15, Directions on Electrometer Board Replacement for a Dasibi Ozone Analyzer.

C.5.2 Solenoid Leak Check/Replacement Procedures

All photometer-style ozone analyzers (Dasibi, Monitor Labs (ML), Thermo Environmental (TECO), and others) rely on a 3-way solenoid valve and a "scrubber" (ozone to oxygen convertor) as part of the measurement process. Both components need to be operating at 100% efficiency for accurate ozone measurement. When either of these components fail, the analyzer exhibits similar symptoms (low response). The following procedures, when performed under the direction of the OSC, will help identify the faulty component.

Over time, the solenoid valve may develop "leaks" allowing a partial flow through a port that should be completely closed. This type of "leak" is a "cross-port" leak (internal to the solenoid) and not a leak due to a loose nut or fitting. The leak check procedures described in the following sections are similar in concept no matter what the brand of ozone analyzer and differ only in component arrangement.

C.5.2.1 Dasibi 1003 - This procedure should be performed upon the direction of the OSC. Please call the OSC before you begin this or any instrument maintenance.

This procedure should be preceded and followed by an overall instrument leak check (Section C.5.4) to eliminate the possibility of a different problem. Refer to Figures C-16, C-17, and C-18 to familiarize yourself with the component placement within the ML 8810 ozone analyzer.

Remove the scrubber using the Kynar nuts. The solenoid valve has two input ports and one output port. (Crossport leaks can be detected by plugging the input ports one at a time with your finger. The sample side of the valve must be plugged in two places, the sample inlet and the scrubber tee (see Figure C-17). As the solenoid valve switches from one input port to the other, the plugged port should cause the flow rate, as observed on the sample pump rotometer, to fall. Observe the effect of plugging both ports separately several times. A solenoid valve that has no leaks should cause the rotometer ball to drop and come to rest on the bottom of the rotometer or vibrate while bouncing on the bottom of the rotometer. A leak is indicated by the rotometer ball not completely falling to the bottom.

Replacement of the solenoid valve is a straight forward procedure that requires common hand tools. Two nuts and lock washers located on the bottom of the chasis hold the valve in place. Kynar or teflon fittings attached to the old solenoid valve may need to be installed onto the new solenoid valve. Care should be given to properly apply teflon tape to the pipe threads of the fitting to ensure a leak-free connection. Electrical connections are made with keyed connectors and sockets eliminating the possibility of error (e.g., plugging into the wrong socket).

C.5.2.2 ML 8810 - This procedure should be performed upon the direction of the OSC. Please call the OSC before you begin this or any instrument maintenance.

This procedure should be preceded and followed by an overall instrument leak check (Section C.5.4) to eliminate the possibility of a different problem. Refer to Figures C-19, C-20, and C-21 to familiarize yourself with the component placement within the ML 8810 ozone analyzer.

The solenoid valve has two input ports and one output port. (Crossport leaks can be detected by plugging the input ports one at a time with your finger. As the solenoid valve switches from one input port to the other, the plugged port should cause the flow rate, as observed on the sample pump rotometer, to fall. Observe the effect of plugging both ports separately several times. A solenoid valve that has no leaks should cause the

rotometer ball to drop and come to rest on the bottom of the rotometer or vibrate while bouncing on the bottom of the rotometer. A leak is indicated by the rotometer ball not completely falling to the bottom.

The solenoid valve is held in place by two nuts on the overhead bracket. The two input ports and on output port tubing connections must be disconnected from the valve as well as the Molex power connector. The power cord to the instrument is disconnected from the outlet to avoid shock hazard. Call the OSC for special instructions before attempting this procedure.

C.5.3 Photometer Lamp Adjustment/Replacement Procedure

C.5.3.1 ML 8810 - Contact the OSC for assistance if unfamiliar with this procedure.

C.5.3.2 Dasibi 1003 - Contact the OSC for assistance if unfamiliar with this procedure.

C.5.4 Overall Instrument Leak Check Procedure

Overall instrument leak checks should be performed as a troubleshooting procedure before instrument maintenance or after replacement of a solenoid valve, scrubber, photometer tube, or any other pneumatic component.

The overall leak check procedure is straightforward, easily performed, and is similar with either the Dasibi series (1003-AH, -RS, -PC, or 1008) or Monitor Labs 8810 analyzers or calibrator/transfer standards.

Review Figures C-16 (Dasibi) or Figure C-19 (Monitor Labs) while performing the following steps:

1) Remove the tubing from the sample inlet of the analyzer

2) Block the analyzer fitting tightly with a clean finger (or capped fitting if available

3) Make sure the analyzer sample pump is operating. As the pump evacuates air from the plugged sample chamber, the flow meter ball should drop to zero (slowly) and stay at zero. It is also acceptable if the ball is chattering (or bouncing) at the bottom of the flow meter.

If any flow is indicated on the flow meter, a leak is occurring at one of the following: the solenoid valve, scrubber, or other pneumatic fitting. Tighten all fittings and repeat the test until no leaks are present.

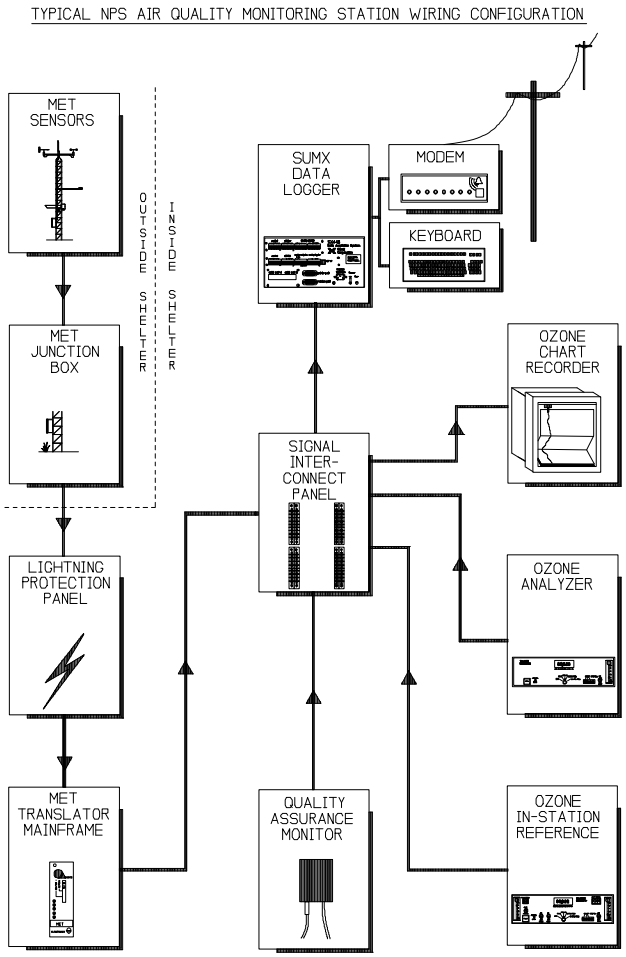


Figure C-1. Typical Air Quality Monitoring Station Wiring Configuration.

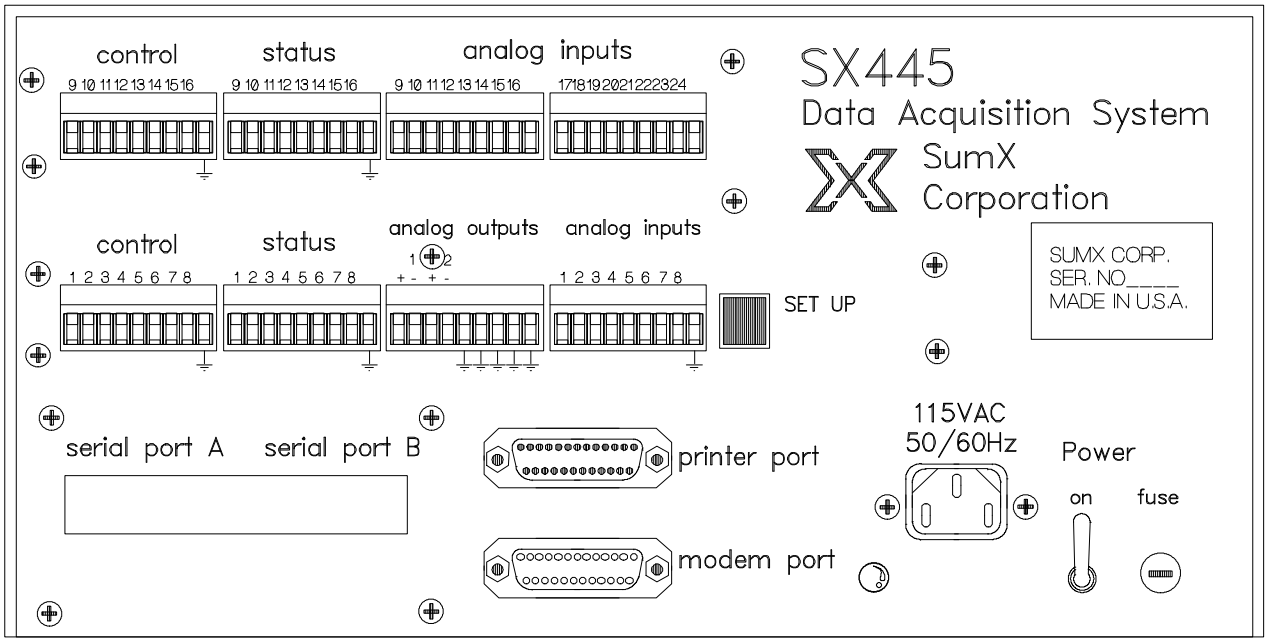


Figure C-2. Rear View of SumX SX445 Data Acquisition System.

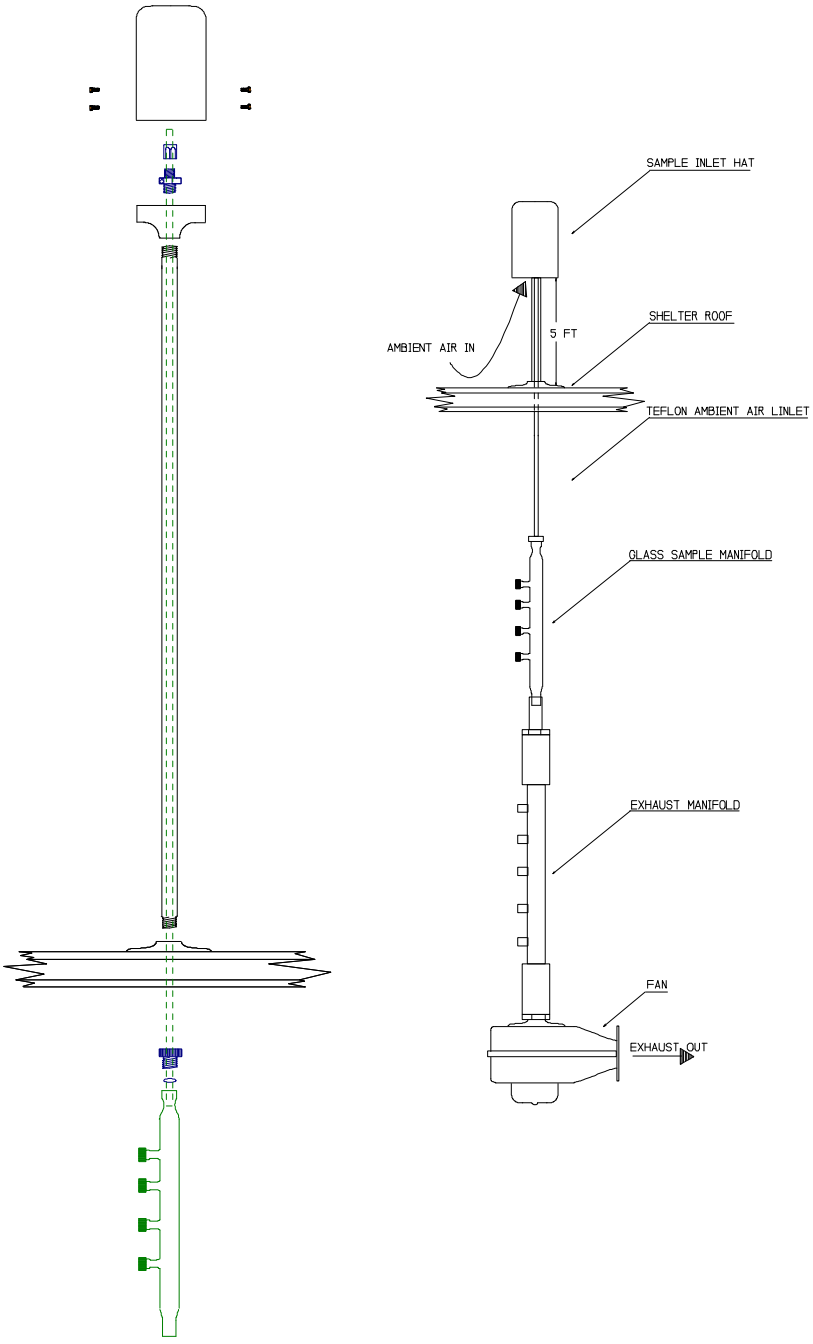


Figure C-3. Sample Intake/Exhaust Manifold Diagram.

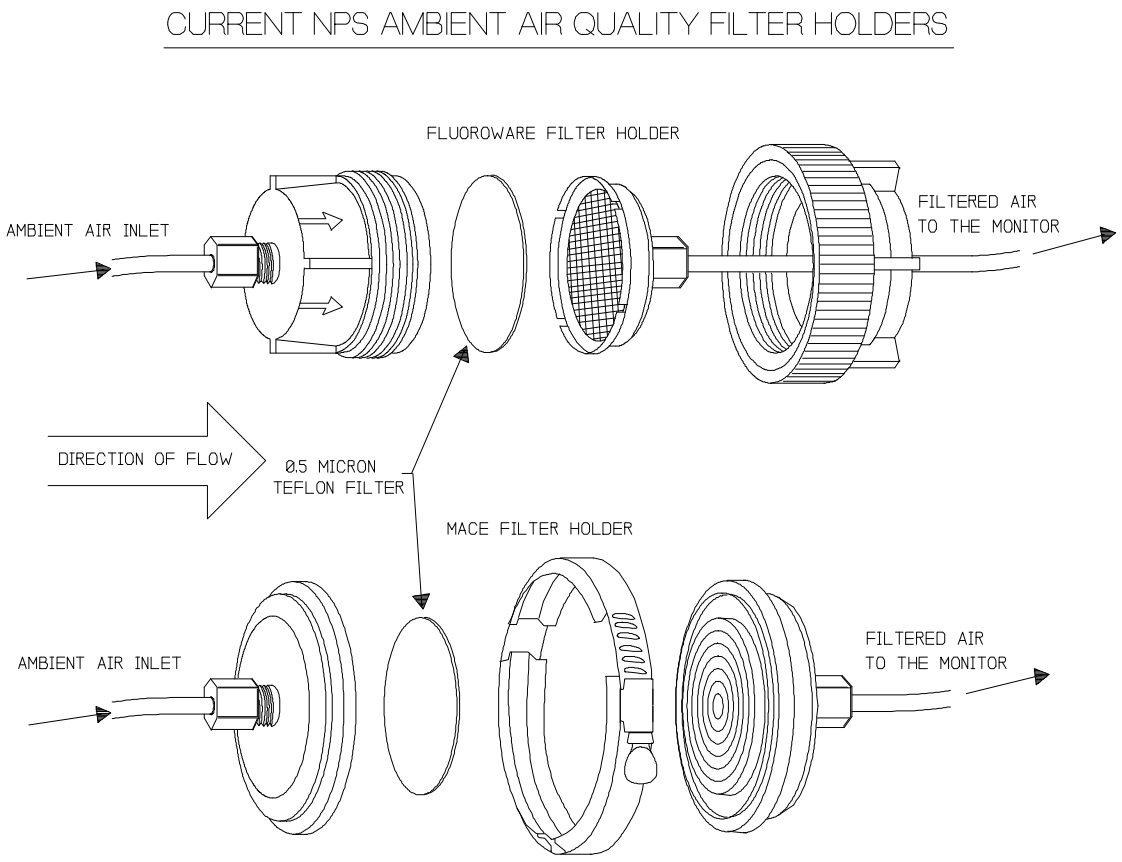


Figure C-4. Analyzer Filter Holders.

Table C-1

Equipment at NPS Air Quality Monitoring Stations

Site	Calibrator	Transfer Standard	Analyzer	SO_2 Analyzer
BIBE		1003-PC	1003-AH	
CANY		1003-PC	1003-AH	
CRMO		1003-PC	ML 8810	
DENA		1003-PC	1003-AH	
DEVA		1003-PC	1003-RS	
EVER		1003-PC	ML 8810	
GRBA		1003-PC	1003-AH	
GRCA		1003-PC	ML 8810	
GRSMCD		1003-AH	1003-PC	
GRSMCM		1003-PC	1003-AH	
GRSMLR		1003-PC	1003-RS	
HALE		1003-PC	1003-AH	
HAVO	TECO 146	1003-PC	CSI-OA325-2R	ML 8850
INDU	5009-CP	5009-CP	ML 8810	TECO 43
JOTR		1003-PC	1003-AH	
LAVO	ML 8550	ML 8810	ML 8810	
MACA		1003-PC	ML 8810	
MORA		1003-PC	1003-AH	
OLYM	TECO 146	1003-PC	ML 8810	TECO 43
PINN		1003-PC	1003-AH	
REDW	ML 8550	ML 8810	ML 8810	
ROMO		1003-PC	ML 8810	
SEKIAM		1003-PC	ML 8810	
SEKIGG		1003-PC	ML 8810	
SEKILK		1003-PC	ML 8810	
SEKILP		1003-PC	TECO 49	
SHENBM		1003-PC	1003-AH	
SHENDR	1009-CP	1009-CP	1003-AH	
SHENSR	5009-CP	5009-CP	1003-AH	
VOYA		1003-PC	1003-AH	
YELL		1003-PC	1003-AH	
YOSECM	ML 8550	ML 8810	ML 8810	
YOSEYV	ML 8550	ML 8810	ML 8810	
YOSEWV		1003-PC	1003-AH	

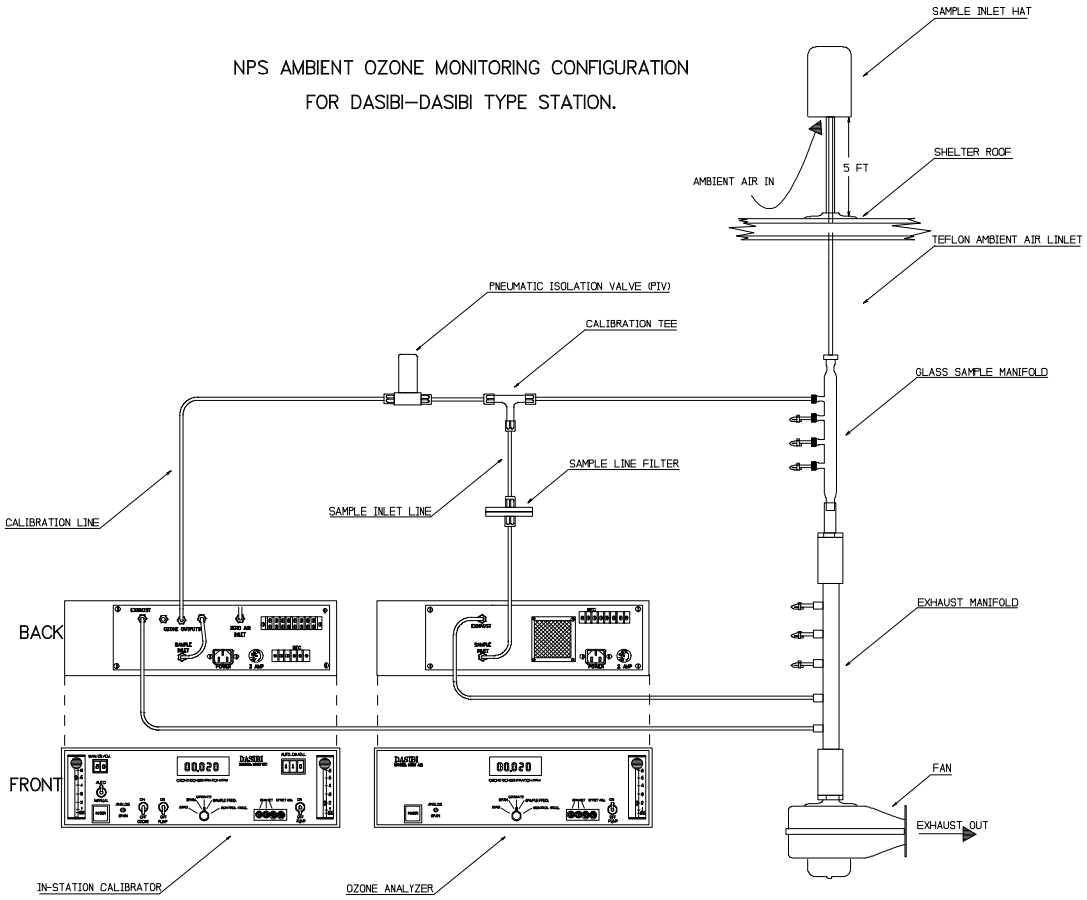


Figure C-5. NPS Ambient Ozone Monitoring Configuration for Dasibi-Dasibi Type Station.

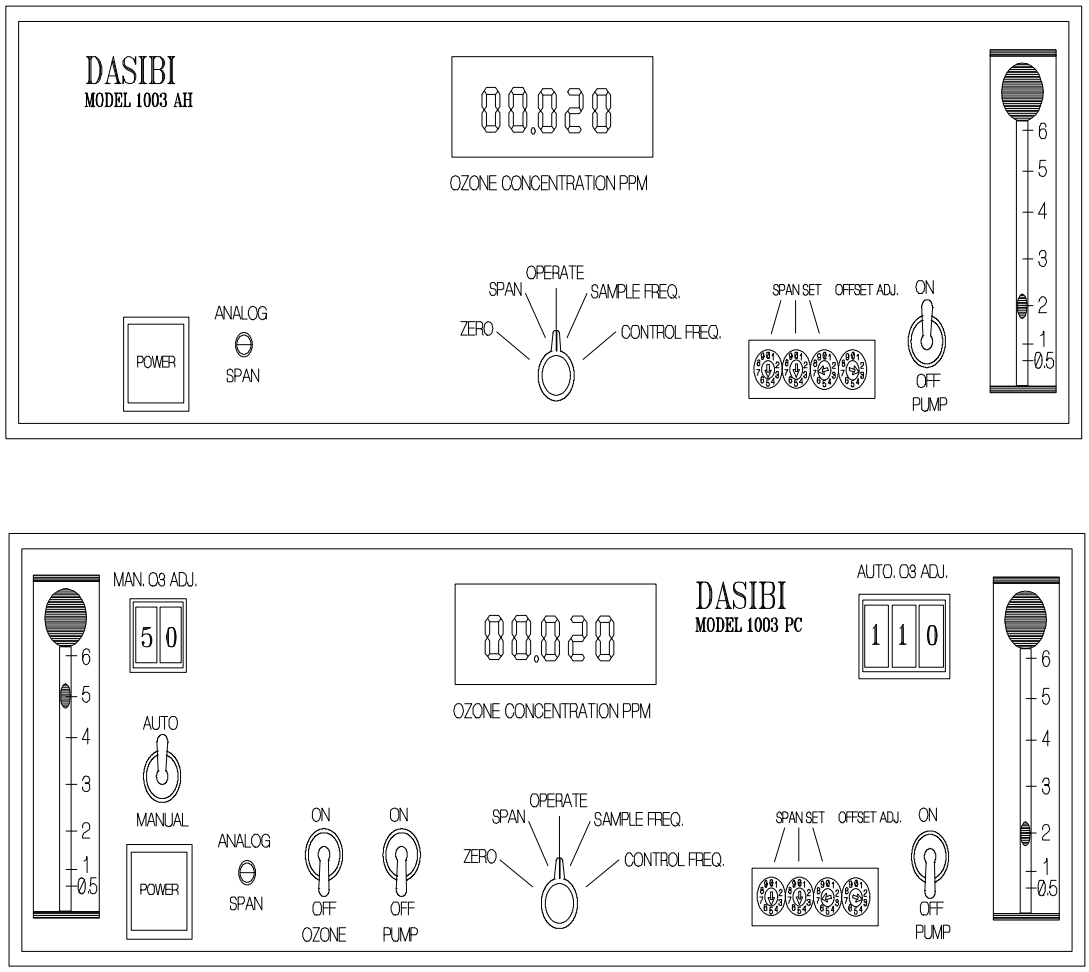


Figure C-6. Close-up Illustration of Dasibi-Dasibi Front Panels.

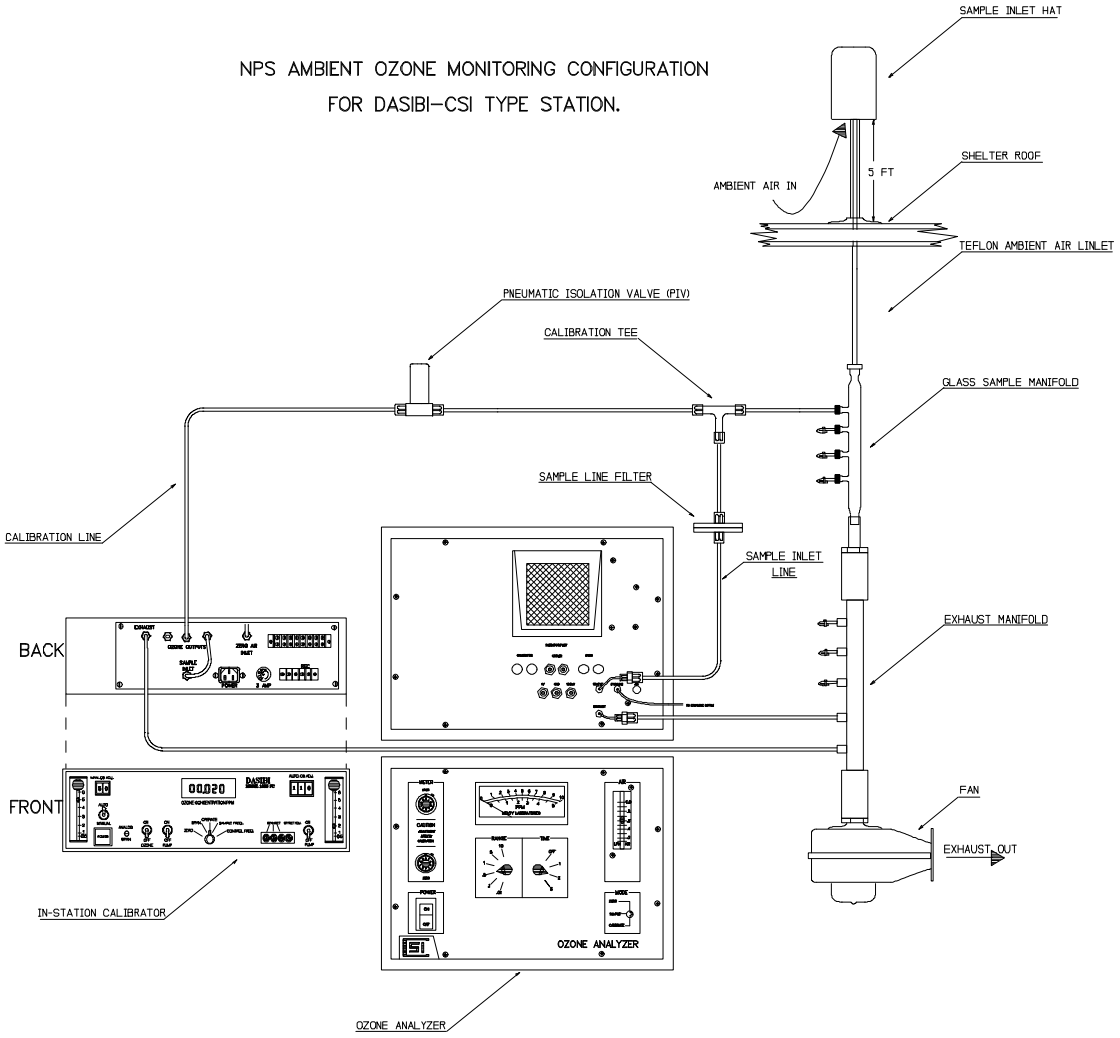


Figure C-7. NPS Ambient Ozone Monitoring Configuration for Dasibi-CSI Type Configuration.

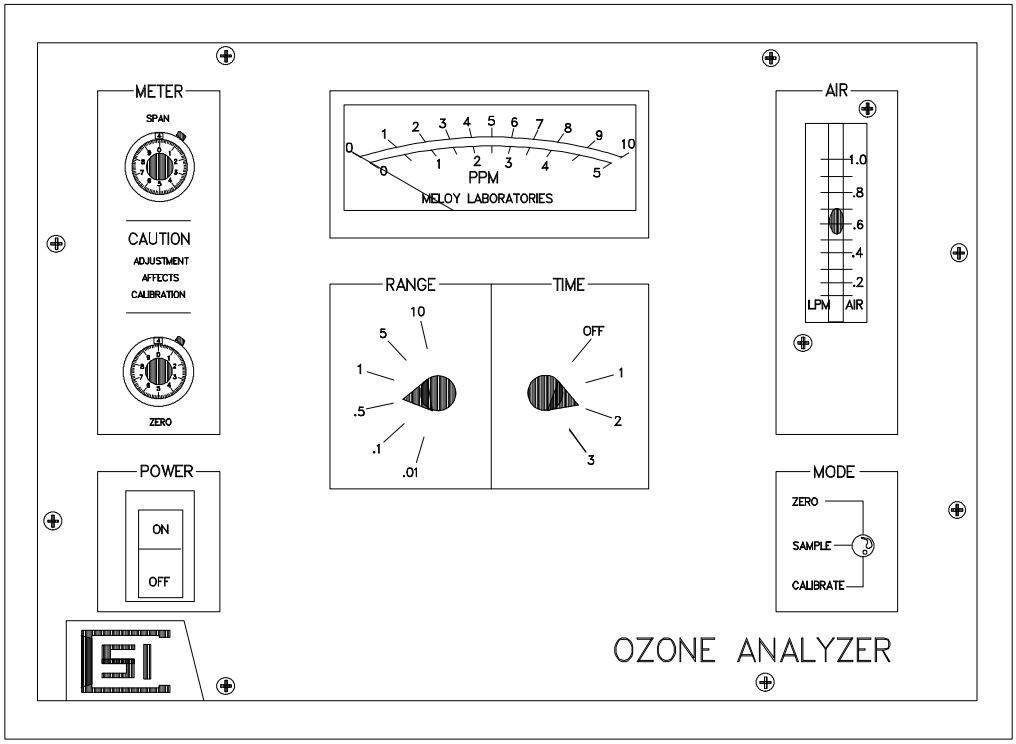


Figure C-8. Close-up Illustration of a CSI Ozone Analyzer Front Panel.

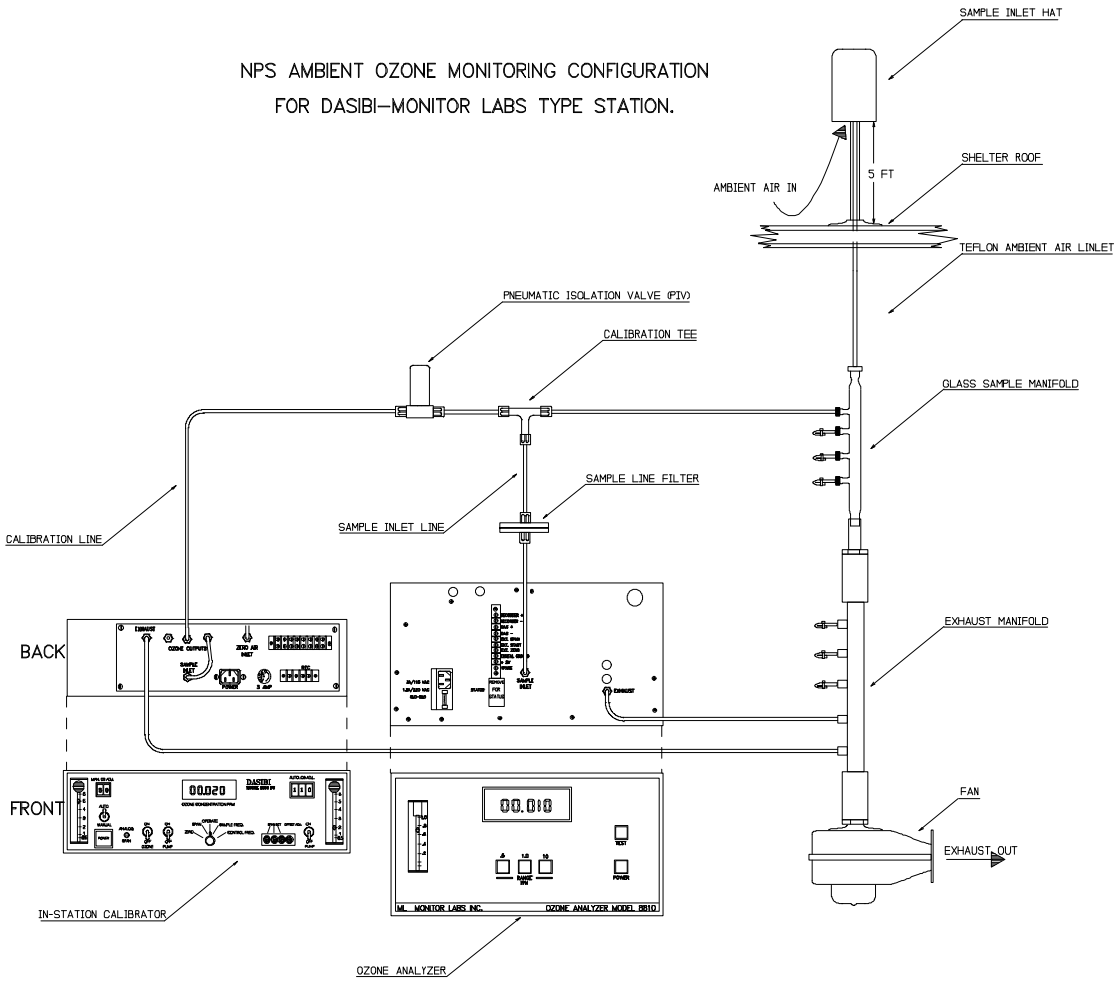


Figure C-9. NPS Ambient Ozone Monitoring Configuration for Dasibi-Monitor Labs Type Station.

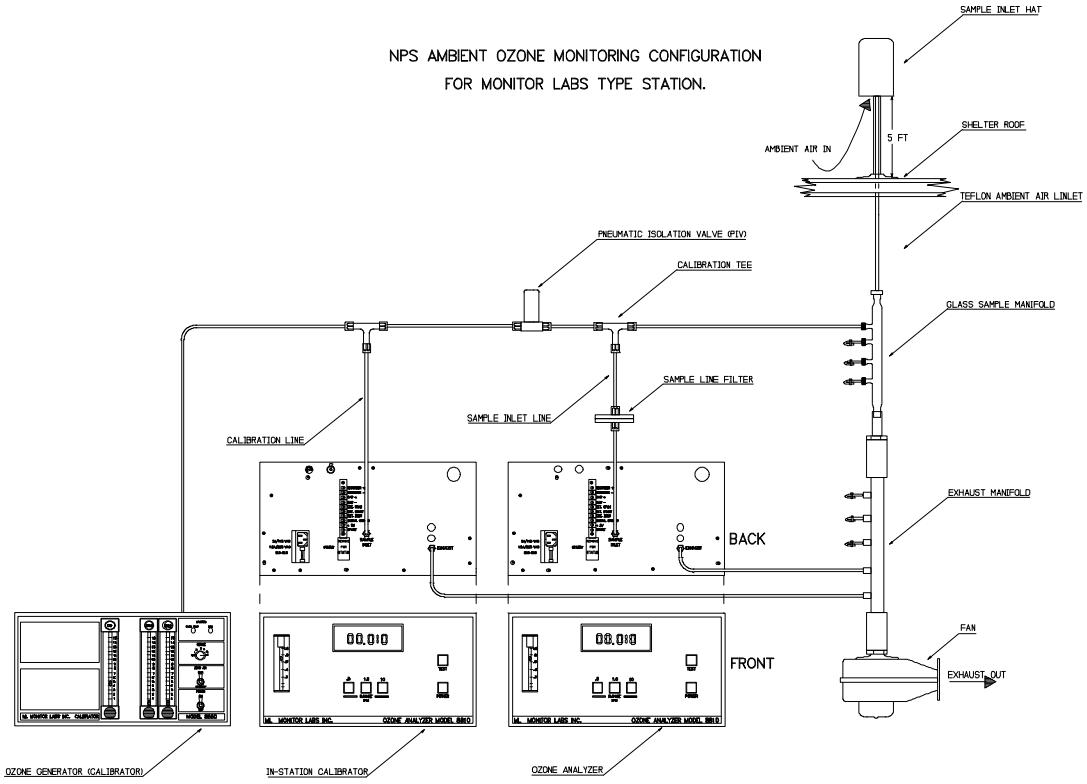


Figure C-10. NPS Ambient Ozone Monitoring Configuration for Monitor Labs Type Station.

Figure C-11. Close-up Illustration of ML 8550 and ML 8810 Front Panels.

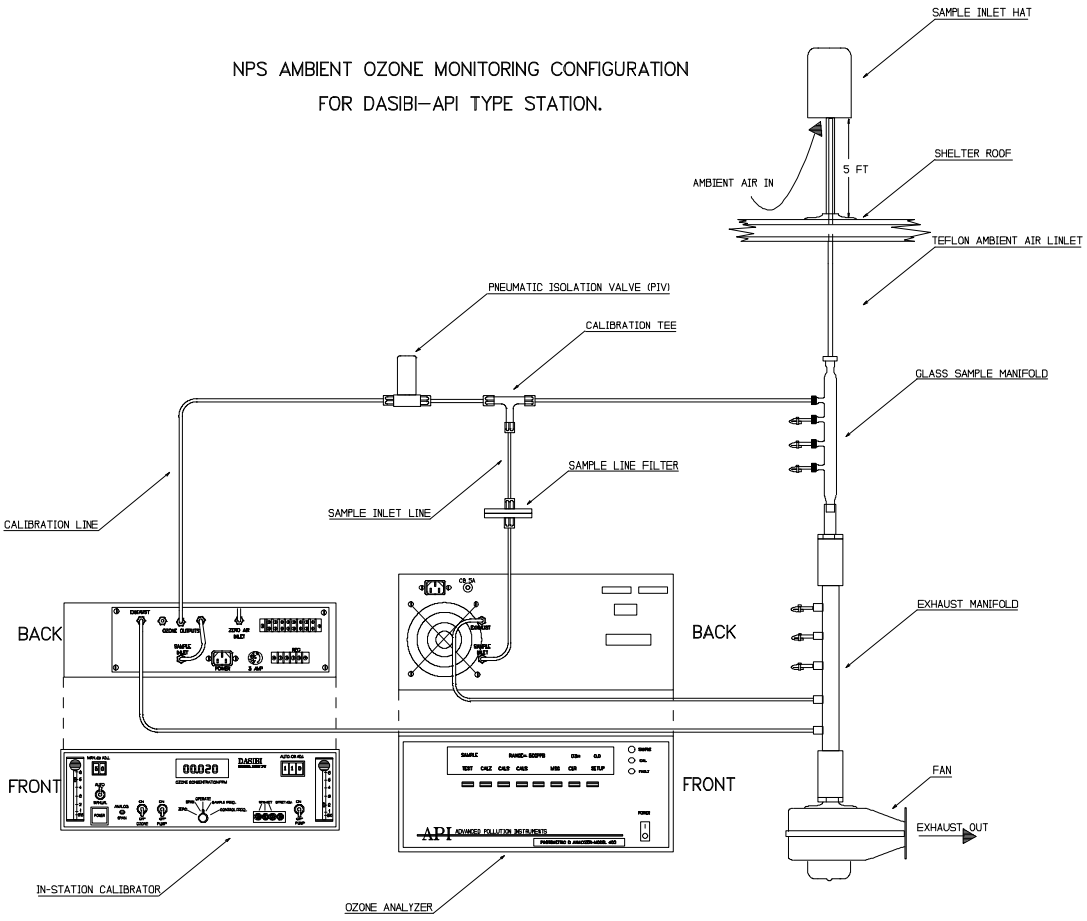


Figure C-12. NPS Ambient Ozone Monitoring Configuration for Dasibi-API Type Station.

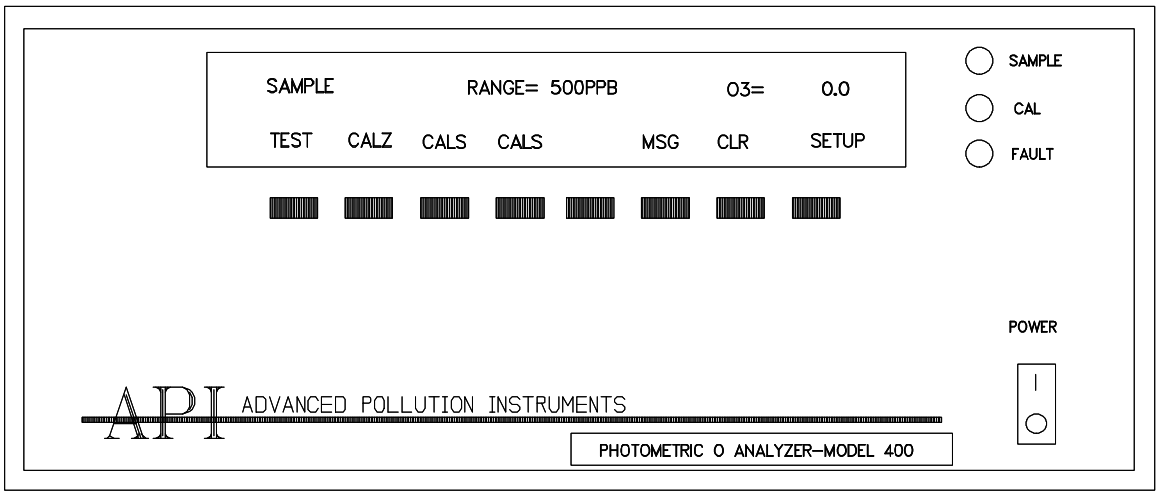


Figure C-13. Close-up Illustration of an API Analyzer Front Panel.

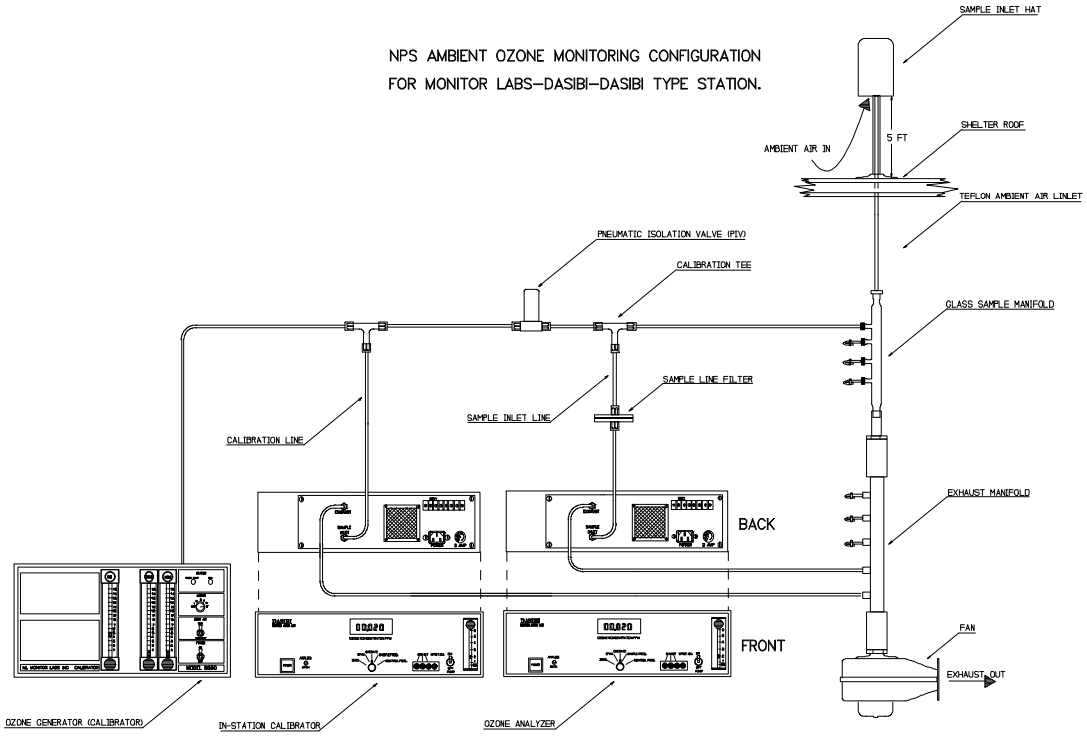
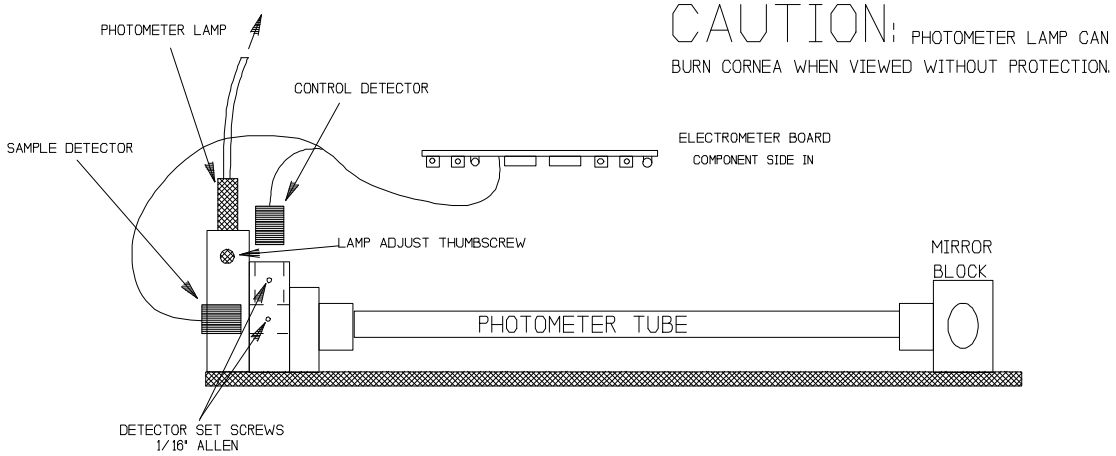


Figure C-14. NPS Ambient Ozone Monitoring Configuration for Monitor Labs-Dasibi-Dasibi Type Station.

ELECTROMETER BOARD REPLACEMENT IN A DASIBI OZONE ANALYZER



CAUTION: PHOTOMETER LAMP CAN BURN CORNEA WHEN VIEWED WITHOUT PROTECTION.

TOP VIEW

OF DASIBI PHOTOMETER

1. TURN OFF POWER AND UNPLUG THE ANALYZER.
2. REMOVE THE TOP COVER OF THE INSTRUMENT.
3. LOOSEN THE DETECTOR SET SCREWS WITH A 1/16" ALLEN WRENCH.
4. PULL THE DETECTORS OUT OF THE BLOCKS.
   THE DETECTORS ARE CONNECTED TO THE ELECTROMETER BOARD.
5. PULL THE ELECTROMETER BOARD OUT WITH THE DETECTORS INTACT.
6. INSTALL THE REPLACEMENT ELECTROMETER IN THE REVERSE ORDER.
   PUSH THE DETECTORS ALL THE WAY IN BEFORE TIGHTENING. THE
   SAMPLE DETECTOR HAS THE LONGEST LEAD.
7. POWER UP THE INSTRUMENT. WHEN THE FREQUENCIES ARE STABLE,
8. PROCEED WITH ADJUSTMENT. SAMPLE= 43.0 TO 48.0
   CONTROL= 23.0 TO 28.0
9. ADJUST THE SAMPLE FREQ. FIRST BY PUSHING/PULLING AND/OR
   ROTATING THE PHOTOMETER LAMP WAITING BETWEEN 24 SECOND UPDATES
   TO OBSERVE THE EFFECT OF THE MOTION.
10. ADJUST THE CONTROL FREQ. BY MOVING THE CONTROL DETECTOR INTO
    THE BLOCK TO INCREASE AND OUT OF TO DECREASE THE FREQUENCY.
11. RE-INSTALL THE TOP COVER AND RETURN THE SWITCH TO OPERATE.

ELECTROM:FCD/MTARS/022593

Figure C-15. Directions on Electrometer Board Replacement for a Dasibi Ozone Analyzer.

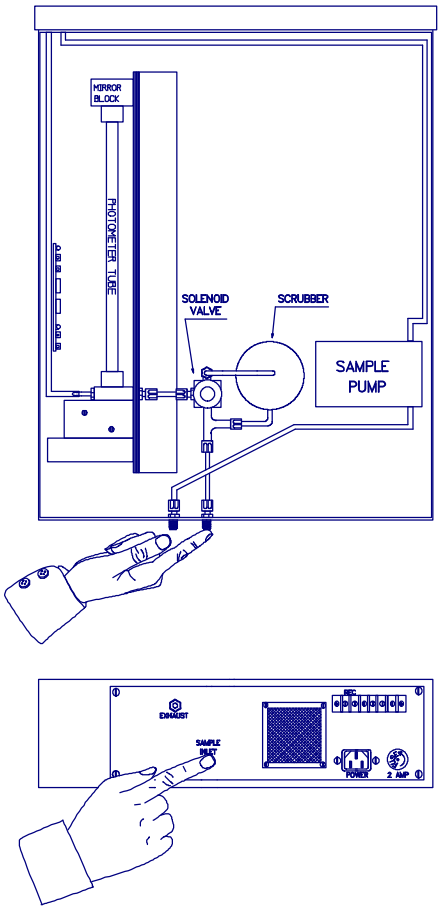


Figure C-16. Dasibi Overall Leak Check.

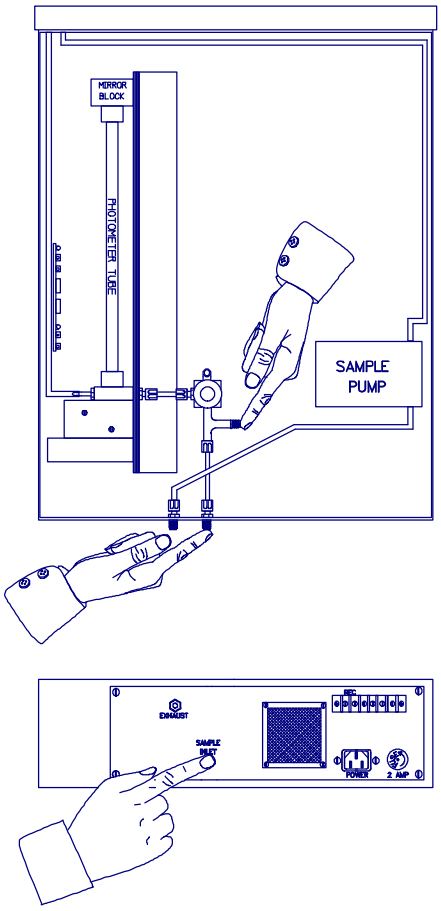


Figure C-17. Dasibi Leak Check of Solenoid Valve Sample Side.

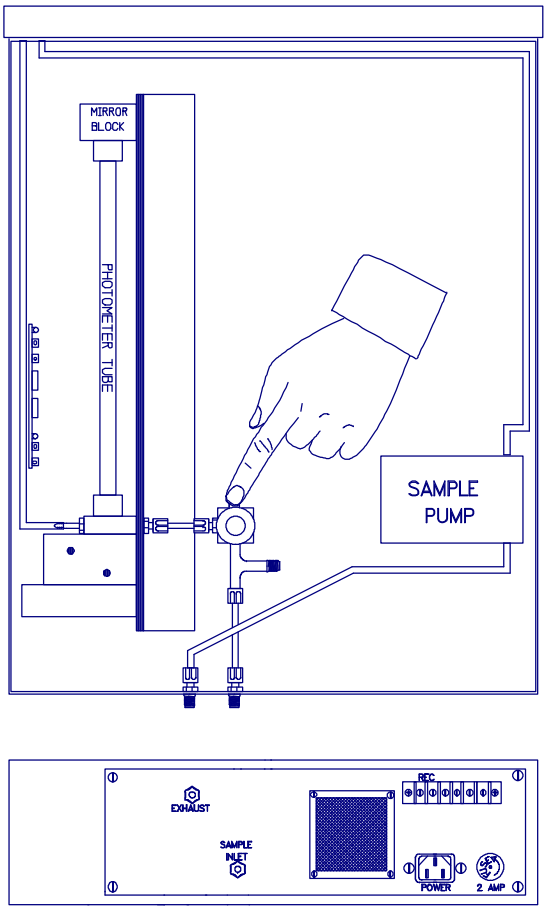


Figure C-18. Dasibi Leak Test of Solenoid Valve Scrubber Side.

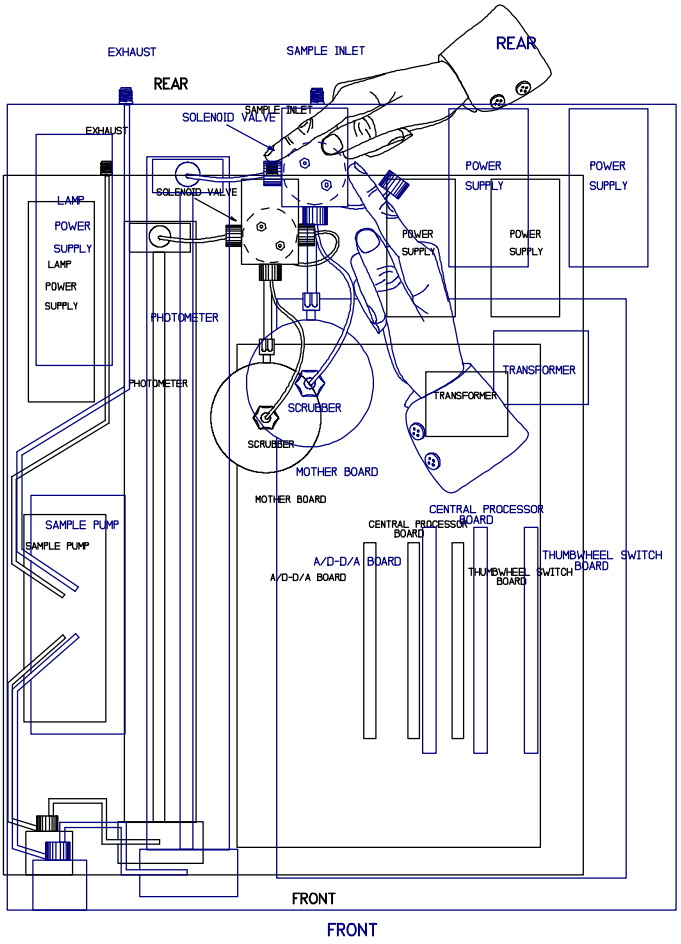


Figure C-19. Monitor Labs Overall Leak Test.

Figure C-20. Monitor Labs Sample Side Solenoid Valve Leak Test.

Figure C-21. Monitor Labs Scrubber Side Solenoid Leak Test.

NATIONAL PARK SERVICE
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Section	**D**
Title	**PRECISION CHECKS**
Origination Date	**JUNE 1994**

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REVISION HISTORY		
EFFECTIVE	CHANGE DESCRIPTION	AUTHORIZATIONS

SECTION D PRECISION CHECKS

Precision checks are required by the Environmental Protection Agency (EPA) for all monitoring instruments collecting data which is to be submitted to the EPA Aerometric Information Retrieval System (AIRS) database. A valid precision check, by definition, must be a pollutant concentration delivered to the analyzer within the range of 0.080 to 0.100 ppm and the analyzer must respond within 10% of the delivered concentration at least once every fourteen (14) days of analyzer operation. All of the Dasibi calibrators (1003-PCs, 1009-CPs, and 5009-CPs), Lear Siegler calibrators (ML 8550s), and Thermo Environmental calibrators (TECO 146) used by the NPS have been modified to automatically perform precision checks. These checks are activated by the SumX data logger every 7 days. If this automatic precision check is not valid, the precision check must be repeated by the station operator. The SOPs contained within Section D guide the station operator through a manually-activated precision check.

Span checks are similar in procedure but span data is used quite differently than precision data. Spans are normally performed daily at 70-90% of the full scale value of the analyzer (0.350-0.450 ppm). This is well above any normally occurring ambient concentration. The primary purpose of performing span checks is to track instrument drift and to evaluate analyzer performance. Precision checks are performed in the 0.080 to 0.100 ppm pollutant concentration range since this is the range where ambient concentrations, particularly ozone, often occur. Precision checks are used to calculate the repeatability of the data being collected by the analyzer.

Documentation of precision checks is critical since failure to perform valid precision checks and/or inadequate reporting of precision checks are both sufficient reasons for the data not being suitable for entry into the AIRS database. In the case a manual precision check is activated by the station operator, results must be thoroughly noted in the station log book.

Weekly automatic and manually-activated precision checks are also documented on a Weekly Zero/Span/Precision Check Control Form, previously discussed in Section A.2.4.

NATIONAL PARK SERVICE
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STANDARD OPERATING PROCEDURES

Section	**D.1**
Title	**MANUALLY-ACTIVATED OZONE PRECISION CHECKS**
Effective Date	**APRIL 1994**

AUTHORIZATIONS		
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Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

D.1 MANUALLY-ACTIVATED OZONE CHECKS

Ozone precision checks are performed automatically once every 7 days. If the automatic event does not occur due to equipment malfunction or power failure, or if the results are not within acceptable ranges, a manual precision check will need to be activated. Valid precision checks are required once every 14 days.

A manually-activated precision check utilizes all the same equipment, tubing, and configuration as an automatic precision check. The difference is that it is commanded to begin by manipulating the SumX data logger's "C" command, either at the station keyboard or remotely from the station operators office, at the OSC facility, or anywhere a terminal, phone line, and modem exist. If a precision is manually-activated from a remote location, a message should be left on the data logger indicating the activity, so the station operator can properly annotate the strip chart during the next station visit.

NATIONAL PARK SERVICE
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STANDARD OPERATING PROCEDURES

Section	**D.1.1**
Title	**PRECISION CHECK OF A CONTINUOUS OZONE ANALYZER USING A DASIBI MODEL 1003-PC CALIBRATOR/TRANSFER STANDARD**
Effective Date	**JUNE 1994**

AUTHORIZATIONS		
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NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

D.1.1 Precision Check of a Continuous Ozone Analyzer Using a Dasibi Model 1003-PC Calibrator/Transfer Standard

D.1.1.1 Precision checks using a Dasibi 1003-PC calibrator/transfer standard will be performed as follows:

- Automatically once every 7 days, immediately before the automatically-activated daily Zero and Span.
- Manually activated at a minimum of once every 14 days, whenever the automatic event activation sequence is not occurring or whenever the automatically activated Precision checks are invalid.

D.1.1.2 The precision check data will be presented on the SumX Daily Summary in the CALIBRATION - RESULTS under LEVEL 1. The station operator will transfer this data to the Weekly Zero/Span/Precision Check Control Form (see Figure A.2-5). A copy is sent to the DPC on a bi-monthly basis (see Section A).

D.1.2 Manually Activated Precision Checks

D.1.2.1 The following sub-sections describe the procedures used by the station operator to perform a manually-activated precision check.

D.1.2.2 Record on the O3 strip chart and in the station log book the time (Local Standard Time), date, operator's first initial and last name, "O3 off-line", and "Begin Precision Check."

D.1.2.3 Verify that the "AUTO O3 ADJ" (Automatic Ozone Adjust) thumbwheel on the Dasibi 1003-PC calibrator is adjusted to the precision point value (usually 110).

NOTES: If the previous precision check is outside the specified range, notify the OSC.

D.1.2.4 Enter the calibration mode using the SumX data logger as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	03, 02 <ENTER>

NOTE: Within 60 seconds the SumX data logger control outputs will activate the precision check. This will be evidenced by the activation of the pneumatic isolation valve (PIV), the ozone generator lamp, and calibrator and sample pumps in the Dasibi 1003-PC.

D.1.2.5 With Events 03 and 02 activated in sequence, Event 03, the Ozone Precision, will run for 30 minutes. After the completion of Event 03, Event 02, the Ozone Zero, will be activated and will run for 15 minutes.

D.1.2.6 After approximately 45 minutes, return to the station and observe the precision check results by performing the following:

D.1.2.6.1 Depress the F5 key (ECHO) on the TRS keyboard to activate the printer.

D.1.2.6.2 Print the precision results by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	Z

D.1.2.7 The most recent calibration results will be printed. After a legible copy of the CALIBRATION SUMMARY has been printed, de-activate the printer by pressing the F5 key on the TRS keyboard. The "ECHO" should be removed from the keyboard display.

D.1.2.8 Review the precision check data and assess for validity using the following criteria: The CAL ACTUAL LEVEL 1 must be between 0.080 and 0.100, and the corresponding O3 ACTUAL LEVEL 1 must be within 10% of the CAL ACTUAL LEVEL 1 value. Record all activities in the station log book. If the precision check results are invalid, contact the OSC for additional assistance.

NOTE: It is also possible to access the SumX data logger and perform these functions remotely via computer and telephone modem. If this is done, make sure to appropriately annotate the strip chart and station log book during your next station visit.

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**D.1.2**
Title	**PRECISION CHECK (AUTOMATIC AND MANUAL) OF A CONTINUOUS OZONE ANALYZER USING A MONITOR LABS MODEL 8550 ZERO AIR SYSTEM WITH AN OZONE SOURCE AND A MONITOR LABS MODEL 8810 TRANSFER STANDARD**
Effective Date	**JUNE 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

D.1.2 Precision Check (Automatic and Manual) of a Continuous Ozone Analyzer Using a Monitor Labs Model 8550 Zero Air System With an Ozone Source and a Monitor Labs Model 8810 Transfer Standard

D.1.2.1 Automatic Precision Check

Precision checks using a Monitor Labs 8550/Monitor Labs 8810 will be performed as follows:

- Automatically once every 7 days, immediately before the automatically-activated daily Zero and Span.
- Manually activated at a minimum of once every 14 days, whenever the automatic event activation sequence is not occurring or whenever the automatically activated Precision checks are invalid.

D.1.2.1.1 The precision check data will be presented on the SumX Daily Summary in the CALIBRATION - RESULTS under LEVEL 1. The station operator will transfer this data to the Weekly Zero/Span/Precision Check Control Form (see Figure A.2-5). A copy is sent to the DPC on a bimonthly basis (see Section A).

D.1.2.2 Manual Precision Check

D.1.2.2.1 The following sub-sections describe the procedures used by the station operator to perform a manually-activated precision check.

D.1.2.2.2 Record on the O3 strip chart and in the station log book the time (Local Standard Time), date, operator's first initial and last name, "O3 off-line", and "Begin Precision Check."

D.1.2.2.3 Enter the calibration mode using the SumX data logger as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	03, 02 <ENTER>

NOTE: Within 60 seconds, the SumX data logger control outputs will activate the precision check. This will be evidenced by the activation of the pneumatic isolation valve (PIV), the ozone generator lamp, and pumps in the zero air system and the Monitor Labs 8810.

D.1.2.2.4 With Events 03 and 02 activated in sequence, Event 03, the Ozone Precision, will run for 30 minutes. After the completion of Event 03, Event 02, the Ozone Zero, will be activated and will run for 15 minutes.

D.1.2.2.5 After approximately 45 minutes, return to the station and observe the precision check results by performing the following:

1. Depress the F5 key (ECHO) on the TRS keyboard to activate the printer.

2. Print the precision results by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	Z

3. The most recent calibration results will be printed. After a legible copy of the CALIBRATION SUMMARY has been printed, de-activate the printer by pressing the F5 key on the TRS keyboard. The "ECHO" should be removed from the keyboard display.

D.1.2.2.6 Review the precision check data and assess for validity using the following criteria: The CAL ACTUAL LEVEL 1 must be between 0.080 and 0.100, and the corresponding O3 ACTUAL LEVEL 1 must be within 10% of the CAL ACTUAL LEVEL 1 value. Record all activities in the station log book and transfer these results to the Weekly Zero/Span/Precision Check Control Chart (see Section A.2.4.1). If the precision check results are invalid, contact the OSC for additional assistance.

NOTE: It is also possible to access the SumX data logger and perform these functions remotely via computer and telephone modem. If this is done, make sure to appropriately annotate the strip chart and station log book during your next station visit.

NATIONAL PARK SERVICE
AIR QUALITY MONITORING
STANDARD OPERATING PROCEDURES

Section	**D.2.1**
Title	**PRECISION CHECK OF A CONTINUOUS OZONE ANALYZER AND A CONTINUOUS SULFUR DIOXIDE ANALYZER USING A DASIBI 5009-CP DILUTION SYSTEM WITH AN INTERNAL OZONE TRANSFER STANDARD PHOTOMETER**
Effective Date	**MAY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
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NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

D.2.1 Precision Check of a Continuous Ozone Analyzer and a Continuous Sulfur Dioxide Analyzer Using a Dasibi 5009-CP Dilution System With an Internal Ozone Transfer Standard Photometer

D.2.1.1 A precision check of a continuous ozone analyzer and a continuous sulfur dioxide analyzer using a Dasibi Model 5009-CP Calibrator is accomplished by introducing to the analyzer's sample stream, gasses of known SO2 and O3 concentrations in the following ranges.

CALIBRATION POINT	CONCENTRATION RANGE, PPM
PRECISION	0.080 - 0.100 (SO2 and O3)
ZERO	0.000 (ZERO GAS)

A precision check must be performed on the SO2 and O3 analyzers a minimum of every 14 days of operation (every 7 days is recommended), or when:

1. Daily SO2 span drift exceeds ±0.040 ppm of a known SO2 concentration, as determined by the results of the dilution of a certified cylinder using the Dasibi 5009-CP calibration system or daily O3 span drift exceeds ±0.040 ppm of a known O3 concentration, as determined by the results of ozone span concentrations generated and measured using the Dasibi Model 5009-CP calibrator/ photometer transfer standard;

2. Daily zero drift for either analyzer exceeds ±0.010 ppm of 0.000;

3. Either analyzer is repaired for any reason;

4. A power outage of more than 24 hours; and/or

5. Physical relocation of either the SO2 or O3 analyzer or the Dasibi 5009-CP calibrator.

D.2.1.2 If not already completed, perform the sulfur dioxide analyzer, the ozone analyzer, and the Dasibi 5009-CP calibration system checks outlined in Section B. Record results on the Weekly Station Checklists. Note in the station log book that Weekly Station Checks were completed.

D.2.1.3 Change the "GAS" thumbwheel setting on the front of the Dasibi 5009-CP calibrator from the SPAN position to the PRECISION position to as noted on the card affixed to the top of the calibrator.

D.2.1.4 Change the "O3 ADJ" thumbwheel from "400" to "090".

D.2.1.5 Place the SumX data logger in the command mode and activate Event 04, the SO2 Precision, Event 05, the O3 Precision, and Event 03, the Zero, as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE	NPSAIR
ACTIVATE WHICH EVENTS IN SEQUENCE?	04, 05, 03, <ENTER>

D.2.1.6 Within a minute, the first event, Event 04, the SO2 Precision, will activate as indicated by the illumination of the "AIR" and "GAS" switches on the front of the Dasibi 5009-CP calibrator. The external zero air supply pump will also be activated.

NOTE: Switch the "DIAG" thumbwheel from "0" to "1". Verify that the digital displays on the front of the Dasibi calibrator for "GAS" and "AIR" match the flow readings noted on the card affixed to the top of the calibrator. If the digital readings do not match those noted on the card, notify the OSC immediately for assistance. Switch the "DIAG" thumbwheel back to "0".

The SO2 Precision will run for approximately 30 minutes when activated in sequence. Since Events 04, 05, and 03 were activated in sequence, following Event 04, Event 05, the O3 Precision, will be automatically activated and will run for approximately 30 minutes. Following Event 05, Event 03, the Zero, will be automatically activated and will run for approximately 15 minutes.

D.2.1.7 Record on the SO2 and O3 strip charts "START SO2 AND O3 PRECISION CHECKS", the time, date, and operator's first initial and last name. Note in the station log book the time that the precision check sequence was activated.

D.2.1.8 After approximately one hour and fifteen minutes, return to the site and verify that the events have de-activated. The "AIR", GAS", and "OZONE" switches on the front of the 5009-CP calibrator should now be off and the external zero air supply pump should be de-activated.

D.2.1.9 Return the GAS thumbwheel setting on the front of the 5009-CP calibrator to the SPAN position as noted on the card affixed to the top of the calibrator and return the "O3 ADJ" thumbwheel from "090" to "400".

D.2.1.10 After entering the site password, print out the precision check results by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	F5 (ECHO)
>	Z

D.2.1.11 The most recent calibration results will be printed. After a legible copy of the CALIBRATION SUMMARY has been printed, deactivate the printer by pressing the F5 key on the TRS keyboard. The "ECHO" should be removed from the keyboard display.

D.2.1.12 Review the precision check data and assess for validity using the following criteria: The CAL ACTUAL LEVEL 1 must be between 0.080 and 0.100, and the corresponding O3 ACTUAL LEVEL 1 must be within 10% of the CAL ACTUAL LEVEL 1 value. The SO2 ACTUAL LEVEL 1 must be between 0.080 and 0.100 ppm. Record all activities in the station log book and transfer these results to the Weekly Zero/Span/Precision Check Control Form (see Section A.2.4). If the precision check results are invalid, contact the OSC for additional assistance.

NOTE: It is also possible to access the SumX data logger and perform these functions remotely via computer and telephone modem. If this is done, make sure to appropriately annotate the strip chart and station log book during your next station visit.

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Section	**D.3.1**
Title	**PRECISION CHECK (AUTOMATIC AND MANUAL) OF A CONTINUOUS SULFUR DIOXIDE ANALYZER USING A THERMO ENVIRONMENTAL INSTRUMENTS (TECO) MODEL 146 DILUTION SYSTEM**
Effective Date	**MAY 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS

D.3.1 Precision Check (Automatic and Manual) of a Continuous Sulfur Dioxide Analyzer Using a Thermo Environmental Instruments (TECO) Model 146 Dilution System

D.3.1.1 Automatic Precision Check

D.3.1.1.1 Precision checks using a TECO Model 146 Gas Dilution System will be performed as follows:

1. Automatically once every 7 days, immediately before the automatically activated daily zero and span;

2. At a minimum of once every two weeks whenever the automatic event activation sequence is not occurring or whenever the automatically activated precision check response of the analyzer is not within ±0.010 ppm of the known sulfur dioxide precision concentration; and/or

3. Prior to adjusting the zero or span potentiometers on the continuous sulfur dioxide analyzer.

As noted above, precision checks are automatically performed every 7 days under the control of the SumX data logger. In the event the automatic system malfunctions or if a manual precision check is required, proceed to Section D.4.1.4.

D.3.1.1.2 The precision check results will be presented on the SumX data logger's daily summary on the CALIBRATION - RESULTS under level 1. This data will be transferred to the Weekly Precision Control Chart, with a copy sent to the DPC on a bi-weekly basis (see Section A).

D.3.1.2 Manual Precision Check

3.3.1.2.1 A manually-activated automatic precision check of the continuous sulfur dioxide analyzer is accomplished by using the TECO 146 gas dilution calibrator to introduce SO2 concentrations in the following ranges:

CALIBRATION POINT	CONCENTRATION RANGE, PPM
ZERO	0.000 (ZERO GAS)
PRECISION	0.080 - 0.100

D.3.1.2.2 If not already completed, perform the TECO 146 calibrator and sulfur dioxide analyzer Weekly Station Checklists as outlined in Sections B.2.6 and B.4. Record results on the Weekly Station Checklists and in the station log book.

1. Place the SumX data logger in the command mode and activate Event 04, the SO2 Precision, and Event 03, the Zero, as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE	NPSAIR
ACTIVATE WHICH EVENTS IN SEQUENCE ?	04, 03 <ENTER>

2. Within a minute, the first event, Event 04, the SO2 Precision, will be activated as indicated by the activation of the external zero air supply pump and the upscale deflection of the AIR and GAS mass flow meters on the front of the TECO 146 gas dilution system.

   NOTE: Verify that the digital displays on the front of the TECO 146 for GAS and AIR match the readings corresponding to the thumbwheel and potentiometer settings as noted on the gas meter calibration form. If the digital readings do not match those noted on the calibration form, notify the OSC immediately for assistance.

   The SO2 precision check will run for approximately 30 minutes when activated in sequence. Since Events 04 and 03 were activated in sequence, following Event 04, Event 03, the Zero, will be automatically activated and will run for approximately 15 minutes.

3. Record on the SO2 and O3 strip charts "START SO2 PRECISION CHECK, the time, date, and operator's first initial and last name. Note in the station log book the time that the precision check sequence was activated.

D.3.1.2.3 After approximately 45 minutes, return to the station and observe the precision check results by performing the following:

1. Depress the F5 key (ECHO) on the TRS keyboard to activate the printer.

2. Print the precision results by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	Z

D.3.1.2.4 The most recent calibration results will be printed. After a legible copy of the CALIBRATION SUMMARY has been printed, de-activate the printer by pressing the F5 key on the TRS keyboard. The "ECHO" should be removed from the keyboard display.

D.3.1.2.5 Review the precision check data and assess for validity using the following criteria: The SO2 ACTUAL LEVEL 1 must be between 0.080 and 0.100. Record all activities in the station log book and transfer the results to the Weekly Zero/Span/Precision Check Control Chart (see Section A.2.4.1). If the precision check results are invalid, contact the OSC for additional assistance.

NOTE: It is also possible to access the SumX data logger and perform these functions remotely via computer and telephone modem. If this is done, make sure to appropriately annotate the strip chart and station log book during your next station visit.

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Section	**E.1.1**
Title	**MULTIPOINT CALIBRATION OF A CONTINUOUS OZONE ANALYZER USING A DASIBI MODEL 1003-PC CALIBRATOR/ TRANSFER STANDARD**
Effective Date	**DECEMBER 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
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NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS
0.1	12/94	Addition to Section E.1.1.9, Linear Regression Analysis, defining and explaining how to calculate linear regression.	John F. Faust

E.1.1 Multipoint Calibration of a Continuous Ozone Analyzer Using a Dasibi Model 1003-PC Calibrator/Transfer Standard

See Figure E.1.1-1, General Guidelines for Ozone Multipoint Calibrations, to become familiar with your station operator responsibilities in regard to the calibrations you will perform.

E.1.1.1 Calibration

E.1.1.1.1 The results of each calibration point are recorded on the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators (see Figure E.1.1.1-1).

Calibration data are summarized and instrumentation parameters are recorded on the Ozone Multipoint Calibration Summary (see Figure E.1.1.1-2).

E.1.1.1.2 Calibration of the 03 analyzer is accomplished by introducing gases of known concentrations, generated and measured by the Dasibi 1003 calibrator/transfer standard, through the normal sampling configuration, in the following ranges:

CALIBRATION POINT	CONCENTRATION RANGE, PPM
1.	0.000 (ZERO GAS)
2.	0.380 - 0.420
3.	0.150 - 0.200
4.	0.030 - 0.080
5.	0.000 (ZERO GAS)

E.1.1.2 Frequency and Duration

E.1.1.2.1 The NPS AQD and its monitoring support contractors recommend that ozone multipoint calibrations be performed each month on the first Tuesday of that month. Calibrations performed according to these procedures should be completed in approximately one hour. Additional calibrations may be required as a result of the following:

- Daily span drift exceeds ±0.040 ppm of a known O3 concentration, as determined by the ozone transfer standard
- Daily zero drift exceeds ±0.010 ppm of 0.000
- A power outage of more than 24 hours
- The analyzer is repaired or replaced
- The ozone calibrator/transfer standard is repaired or replaced.

1. Ozone multipoint calibrations are recommended monthly. The calibration should be performed on the first Tuesday of each month. Results of all multipoint calibrations are called into the Monitoring Support Contractor for evaluation and discussion.

2. The multipoint calibration is performed with no changes in the sample line configuration. If the calibration is required as a result of span drift, however, a sample line integrity check (SLIC) will be required. Please perform SLICs only under the direction of the Monitoring Support Contractor. If the slope between the calibrator and the ozone analyzer is between 0.90 and 1.10, no SLIC is required.

3. The sequence of events for performing a multipoint calibration is as follows:

CAL POINT	PPM RANGE
1.	ZERO
2.	high value (concentration range between 0.380 and 0.420 ppm
3.	mid-range value (concentration range between 0.150 and 0.200 ppm)
4.	low range value (concentration range between 0.030 and 0.080 ppm)
5.	ZERO

4. Upscale calibration points should be performed by activating event 03, the Precision Check event, since this provides the Dasibi 1003-PC calibrators to output calibration concentrations which correspond to the "AUTO O3 ADJ" thumbwheel.

5. Zero calibration points are performed by activating Event 02 before and after running the upscale calibration points.

6. The following "AUTO O3 ADJ" thumbwheel values are recommended for the upscale calibration points.

CAL POINT	"AUTO O3 ADJ" Thumbwheel Setting
2.	420
3.	200
4.	080

NOTE: The position of the "AUTO O3 ADJ" thumbwheel during zero calibration events is irrelevant since the ozone generator lamp is not activated during the zero event.

Make certain to return the "AUTO O3 ADJ" thumbwheel to the auto Precision Check position (110) after running the last upscale calibration point.

Figure E.1.1-1. General Guidelines for Ozone Multipoint Calibrations.

SITE NAME: _____ OPERATOR: _____ 1003-PC SAMPLE FLOW _____

DATE: _____ CHART FORMULA: _____ 1003-PC CAL FLOW _____

CAL POINT #1 (PPM RANGE ZERO)
1003-PC AUTO O3 ADJ: N/A

	ANALYZER DISPLAY	SUMX O3 EUs	1003-PC DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #2 (PPM RANGE 0.380-0.420)
1003-PC AUTO O3 ADJ: _____

	ANALYZER DISPLAY	SUMX O3 EUs	1003-PC DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #3 (PPM RANGE 0.150-0.200)
1003-PC AUTO O3 ADJ: _____

	ANALYZER DISPLAY	SUMX O3 EUs	1003-PC DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #4 (PPM RANGE 0.030-0.080)
1003-PC AUTO O3 ADJ: _____

	ANALYZER DISPLAY	SUMX O3 EUs	1003-PC DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #5 POST CALIBRATION ZERO VERIFICATION

	ANALYZER DISPLAY	SUMX O3 EUs	1003-PC DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

Figure E.1.1.1-1. Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators.

OZONE MULTIPOINT CALIBRATION SUMMARY
USING A DASIBI 1003-PC OZONE CALIBRATOR

SITE NAME: _____ DATE: _____
OPERATOR: _____

INSTRUMENT INFORMATION:

	ANALYZER	CALIBRATOR/ TRANSFER STANDARD	DATA LOGGER
MANUFACTURER:		DASIBI	SUMX
MODEL:		1003-PC	444/445
SERIAL #			
NPS PROP #			
DATE OF CERT/CAL*			
INSTRUMENT			XXXXXXXXXX
SPAN SETTING			XXXXXXXXXX
SAMPLE FLOW-LPM			XXXXXXXXXX
SAMPLE FREQUENCY			XXXXXXXXXX
CONTROL FREQUENCY			XXXXXXXXXX
UV LAMP INTENSITY		XXXXXXXXXX	XXXXXXXXXX

MULTIPOINT CALIBRATION SUMMARY:

NOTE: THE FOLLOWING CALIBRATION POINTS WERE INTRODUCED THROUGH THE SAMPLE PROBE IN THE NORMAL SAMPLE CONFIGURATION. NO ADJUSTMENTS WERE MADE TO THE INSTRUMENTS.

CAL POINT	PPM RANGE	SUMX O3 EUs	SUMX CAL EUs	CHART %	CHART PPM**
1.	ZERO				
2.	(0.380-0.420)				
3.	(0.150-0.200)				
4.	(0.030-0.080)				
5.	ZERO ***				

LINEAR REGRESSION ANALYSIS: ANALYZER RESPONSE vs CALIBRATOR RESPONSE O3 PPM (Y) vs CAL PPM (X)
SLOPE: _____ (1.100 > m > 0.900) RESULTS PHONED TO ARS ? (Y/N)___
INTERCEPT: _____ (-0.005 < b < +0.005) ARS CONTACT: _____
CORRELATION: _____ (r > 0.9995) RESULTS OK? (Y/N) _____

* Corresponds with the last contractor site visit OR instrument repair at support lab.
** SumX O3 EUs minus chart ppm must be < +/- 0.008 ppm.
*** CAL POINT #1 minus CAL POINT #5 for SumX CAL EUs and SumX O3 EUs must be <0.003 ppm.

Figure E.1.1.1-2. Ozone Multipoint Calibration Summary.

E.1.1.3 Instrumentation Information

E.1.1.3.1 Complete the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators (see Figure E.1.1.1-1) and the top section of Ozone Multipoint Calibration Summary (see Figure E.1.1.1-2). Fill in the site name, date, operator (first initial and full last name), and chart formula. Please note that the 1003-PC sample flow and cal flow cannot be recorded until a calibration event is activated (see Sub-section E.1.1.4.1).

E.1.1.3.2 Complete the INSTRUMENTATION INFORMATION section of the Ozone Multipoint Calibration Summary. This information is similar to the information required on the Weekly Station Checklists. For assistance, please refer to Section B, Weekly Station Checklists, or call the Monitoring Support Contractor.

E.1.1.4 CAL POINT #1 (ppm range zero)

E.1.1.4.1 Activate event 02, the ozone zero using the SumX data logger by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	02 <ENTER>

NOTE: Immediately you should notice the activation of the pumps in the Dasibi 1003 calibrator as evidenced by the upscale response of the flow rotameters on the front of the calibrator. These flow readings should be recorded on the top of the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators.

E.1.1.4.2 Mark the strip chart indicating the time, date, "begin ozone multipoint calibration", and your first initial and last name. Note in the Station Log Book the time that the event was activated and that the ozone multipoint calibration has begun.

E.1.1.4.3 When the strip chart has stabilized (approximately 5 minutes), begin recording the readings from the front panel displays of the ozone analyzer and the 1003-PC calibrator and the SumX data logger engineering units (EUs) on the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators once every minute for the next 5 minutes.

To obtain SumX data logger engineering units, perform the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	M
VIEW COLUMN NUMBERS	____(O3) ____(CAL)<ENTER>

NOTE: Hit the space bar several times to get one minute read outs. Pressing F5 (ECHO) will allow for these values to be printed.

E.1.1.4.4 Once each minute for five consecutive minutes, record the following in the CAL POINT #1 section of the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators:

- The number displayed on the front of the analyzer (OZONE CONCENTRATION PPM) under the ANALYZER DISPLAY column on the data worksheet
- The number in the O3 column displayed on the keyboard under the SumX data logger 03 EUs column on the data worksheet
- The number displayed on the front of the calibrator (OZONE CONCENTRATION PPM) under the 1003-PC DISPLAY column on the data worksheet
- The number in the CAL column displayed on the keyboard under the SumX CAL EUs column on the data worksheet

E.1.1.4.5 Average out each column on the data worksheet and record in the row labeled MEAN (average).

E.1.1.4.6 Record the strip chart percentage and calculate and record the chart ppm using the appropriate equation (the equation should be written on a label affixed to the chart recorder).

E.1.1.4.7 Transfer the information recorded in steps E.1.1.4.5 and E.1.1.4.6 to the Ozone Multipoint Calibration Summary.

E.1.1.4.8 Escape out of the M function by pressing <ESC>.

E.1.1.4.9 Deactivate event 02 by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>

ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)?	02 <ENTER>

NOTE: Immediately you should notice the de-activation of the pumps in the Dasibi 1003 calibrator as evidenced by the sudden quietness in the monitoring shelter.

E.1.1.5 CAL POINT #2 (ppm range 0.380-0.420)

E.1.1.5.1 Change the AUTO 03 ADJ thumbwheel setting to 420.

E.1.1.5.2 Activate Event 03. This is normally the precision check event, however, this event allows you to generate predictable ozone concentrations by using the AUTO O3 ADJ thumbwheel. Because of the instrument offset, the actual output concentration of the calibrator will be approximately 20 parts per billion (0.020 ppm) below the thumbwheel setting. Event 03 is activated as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	03 <ENTER>

E.1.1.5.3 Repeat steps E.1.1.4.3 through E.1.1.4.7 and record the results in the CAL POINT #2 section of the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators and in the Multipoint Calibration Summary section of the Ozone Multipoint Calibration Summary.

E.1.1.6 CAL POINT #3 (ppm range 0.150-0.200)

E.1.1.6.1 Change the AUTO 03 ADJ thumbwheel setting from 420 to 200.

E.1.1.6.2 Repeat steps E.1.1.4.3 through E.1.1.4.7 and record the results in the CAL POINT #3 section of the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators and in the Multipoint Calibration Summary section of the Ozone Multipoint Calibration Summary.

E.1.1.7 CAL POINT #4 (ppm range 0.030-0.080)

E.1.1.7.1 Change the AUTO 03 ADJ thumbwheel setting from 200 to 080.

E.1.1.7.2 Repeat steps E.1.1.4.3 through E.1.1.4.7 and record the results in the CAL POINT #4 section of the Ozone Multipoint Calibration Raw Data Worksheet for Dasibi 1003-PC Calibrators and in the Multipoint Calibration Summary section of the Ozone Multipoint Calibration Summary.

E.1.1.8 CAL POINT #5 (Post Calibration Zero Verification)

E.1.1.8.1 Escape out of the M function by pressing <ESC>.

E.1.1.8.2 Return the AUTO 03 ADJ thumbwheel setting from 080 to its original value (110).

E.1.1.8.3 Deactivate Event 03 by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)?	03 <ENTER>

E.1.1.8.4 Activate Event 02, Zero, by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	02 <ENTER>

E.1.1.8.5 When the strip chart has stabilized (approximately 5 minutes), begin recording **ONLY** the SumX keyboard readings (do not record analyzer and calibrator displays) on the bottom of the data worksheet, once every minute for the next 5 minutes.

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	M
VIEW COLUMN NUMBERS)?	____(O3) ____(CAL)<ENTER>

NOTE: Hit the space bar a couple of times to get one minute read outs.

E.1.1.8.6 Average out each row on the data worksheet and record at the end of the row in the column labeled MEAN.

E.1.1.8.7 Escape out of the M function by pressing <ESC>.

E.1.1.8.8 Deactivate Event 02 by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)?	02 <ENTER>

E.1.1.8.9 Record "on-line" on the strip chart. Note in the Station Log Book the completion of the ozone multipoint calibration.

E.1.1.9 Linear Regression Analysis

A linear regression is a statistical method for finding a straight line that best fits a set of x,y- data. The straight line provides a relationship between the x- and y-variables: $y = mx + b$, where m is the slope and b is the y-intercept.

To calculate the linear regression, use the "SumX CAL EUs" and the SumX O3 EUs" values from the Ozone Multipoint Calibration Summary Form. Assign x to the SumX CAL EUs (independent variable) and y to the SumX O3 EUs (dependent variable). Enter only one set of zero values (CAL POINT 1) and the corresponding sets of values for CAL POINT 2, 3, and 4.

Phone the results of the calibration to the Monitoring Support Contractor for evaluation and discussion. If you are unable to do so, or do not have access to a calculator or computer program that will calculate the results of the linear regression analysis, the OSC will perform these calculations for you.

E.1.1.10 Sending Copies

Send the copy with the bi-weekly station visit report. Keep the originals at the station.

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STANDARD OPERATING PROCEDURES

Section	**E.1.2**
Title	**MULTIPOINT CALIBRATION OF A CONTINUOUS OZONE ANALYZER USING A MONITOR LABS MODEL 8550 CALIBRATOR AND A MONITOR LABS MODEL 8810 TRANSFER STANDARD**
Effective Date	**DECEMBER 1994**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
Originator		
NPS COTR	Ron Lawler Heavner	
NPS QA Officer	John D. Ray	
Other		

REVISION HISTORY			
REVISION NO.	EFFECTIVE DATE	CHANGE DESCRIPTION	AUTHORIZATIONS
0.1	12/94	Addition to Section E.1.1.9, Linear Regression Analysis, defining and explaining how to calculate linear regression.	John F. Faust

E.1.2 Multipoint Calibration of a Continuous Ozone Analyzer Using a Monitor Labs Model 8550 Calibrator and a Monitor Labs Model 8810 Transfer Standard

See Figure E.1.2-1, General Guidelines for Ozone Multipoint Calibrations, to become familiar with your station operator responsibilities in regard to the calibrations you will perform.

E.1.2.1 Calibrations

E.1.2.1.1 The results of each calibration point are recorded on the Ozone Multipoint Calibration Raw Data Worksheet for Monitor Labs (ML) 8550 calibrators (Figure E.1.2.1-1).

Calibration data are summarized and instrumentation parameters are recorded on the Ozone Multipoint Calibration Summary (see Figure E.1.2.1-2).

E.1.2.1.2 Calibration of the 03 analyzer is accomplished by introducing gases of known concentrations, generated by the ML 8550, and measured by the ML 8810 transfer standard, through the normal sampling configuration, in the following ranges:

CALIBRATION POINT	CONCENTRATION RANGE, PPM
1.	0.000 (ZERO GAS)
2.	0.380 - 0.420
3.	0.150 - 0.200
4.	0.030 - 0.080
5.	0.000 (ZERO GAS)

E.1.2.2 Frequency and Duration

E.1.2.2.1 The NPS AQD and the OSC recommend that ozone multipoint calibrations be performed each month on the first Tuesday of that month. Calibrations performed according to these procedures should be completed in approximately one hour. Additional calibrations may be required as a result of the following:

- Daily span drift exceeds ±0.040 ppm of a known O3 concentration, as determined by the ozone transfer standard
- Daily zero drift exceeds ±0.010 ppm of 0.000
- A power outage of more than 24 hours
- The analyzer is repaired or replaced
- The ozone calibrator/transfer standard is repaired or replaced.

1. Ozone multipoint calibrations are recommended monthly. The calibration should be performed on the first Tuesday of each month. Results of all multipoint calibrations are called into the OSC for evaluation and discussion.

2. The multipoint calibration is performed with no changes in the sample line configuration. If the calibration is required as a result of span drift, however, a sample line integrity check (SLIC) will be required. Please perform SLICs only under the direction of the OSC. If the slope between the calibrator and the ozone analyzer is between 0.90 and 1.10, no SLIC is required.

3. The sequence of events for performing a multipoint calibration is as follows:

CAL POINT	PPM RANGE
1.	ZERO
2.	high value (concentration range between 0.380 and 0.420 ppm
3.	mid-range value (concentration range between 0.150 and 0.200 ppm)
4.	low range value (concentration range between 0.030 and 0.080 ppm)
5.	ZERO

4. Upscale calibration points should be performed by activating Event 01, the Span. Ozone concentration levels output by the ML 8550 calibrator are dependent upon the position of the "ozone" intensity switch (1 through 6) and the "ozone" rotometer ball height.

5. Zero calibration points are performed by activating Event 02 before and after running the upscale calibration points.

6. The following "ozone" intensity switch positions are recommended for the upscale calibration points.

CAL POINT	"OZONE" Switch Intensity
2.	5
3.	4
4.	3

NOTE: The ozone concentration output of individual calibrators is highly variable and difficult to predict. A combination of "OZONE" switch position and dilution flow rate (rotometer adjustment) may be required to achieve the desired values. Do not adjust the rotometer below 2.5.

Return the "OZONE" intensity switch and rotometer ball height to their original positions after the multipoint calibration.

Figure E.1.2-1. General Guidelines for Ozone Multipoint Calibrations.

SITE NAME: _____ OPERATOR: _____ ML 8810 SAMPLE FLOW _____

DATE: _____ CHART FORMULA: _____ ML 8810 TRANSFER STANDARD FLOW _____

CAL POINT #1 (PPM RANGE ZERO)
ROTOMETER BALL HEIGHT_____

	ANALYZER DISPLAY	SUMX O3 EUs	TRANSFER STANDARD DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #2 (PPM RANGE 0.380-0.420)
ML 8550 OZONE SWITCH _____
ROTOMETER BALL HEIGHT _____

	ANALYZER DISPLAY	SUMX O3 EUs	TRANSFER STANDARD DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #3 (PPM RANGE 0.150-0.200)
ML 8550 OZONE SWITCH _____
ROTOMETER BALL HEIGHT _____

	ANALYZER DISPLAY	SUMX O3 EUs	TRANSFER STANDARD DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #4 (PPM RANGE 0.030-0.080)
ML 8550 OZONE SWITCH _____
ROTOMETER BALL HEIGHT _____

	ANALYZER DISPLAY	SUMX O3 EUs	TRANSFER STANDARD DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

CAL POINT #5 POST CALIBRATION ZERO VERIFICATION

	ANALYZER DISPLAY	SUMX O3 EUs	TRANSFER STANDARD DISPLAY	SUMX CAL EUs
1				
2				
3				
4				
5				
MEAN				

CHART % _____ CHART PPM _____

Figure E.1.2.1-1. Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators.

OZONE MULTIPOINT CALIBRATION SUMMARY
USING A MONITOR LABS 8550 CALIBRATOR

SITE NAME: _____ DATE: _____
OPERATOR: _____

INSTRUMENT INFORMATION:

	ANALYZER	TRANSFER STANDARD	CALIBRATOR	DATA LOGGER
MANUFACTURER:			MONITOR LABS	SUMX
MODEL:			8550	444/445
SERIAL #				
NPS PROP #				
DATE OF CERT/CAL			*	*
SPAN SETTING			XXXXXXXXXX	XXXXXXXXXX
SAMPLE FLOW-LPM			XXXXXXXXXX	XXXXXXXXXX
SAMPLE FREQUENCY			XXXXXXXXXX	XXXXXXXXXX
CONTROL FREQUENCY			XXXXXXXXXX	XXXXXXXXXX
UV LAMP INTENSITY			XXXXXXXXXX	XXXXXXXXXX

MULTIPOINT CALIBRATION SUMMARY:

NOTE: THE FOLLOWING CALIBRATION POINTS WERE INTRODUCED THROUGH THE SAMPLE PROBE IN THE NORMAL SAMPLE CONFIGURATION. NO ADJUSTMENTS WERE MADE TO THE INSTRUMENTS.

CAL POINT	PPM RANGE	SUMX O3 EUs	SUMX CAL EUs	CHART %	CHART PPM**
1.	ZERO				
2.	(0.380-0.420)				
3.	(0.150-0.200)				
4.	(0.030-0.080)				
5.	ZERO ***				

LINEAR REGRESSION ANALYSIS: ANALYZER RESPONSE vs CALIBRATOR RESPONSE O3 PPM (Y) vs CAL PPM (X)
SLOPE: _____ (1.100 > m > 0.900) RESULTS PHONED TO ARS ? (Y/N)___
INTERCEPT: _____ (-0.005 < b < +0.005) ARS CONTACT: _____
CORRELATION: _____ (r > 0.9995) RESULTS OK? (Y/N) _____

* Corresponds with the last contractor site visit OR instrument repair at support lab.
** SumX O3 EUs minus chart ppm must be <±0.008 ppm.
*** CAL POINT #1 minus CAL POINT #5 for SumX CAL EUs and SumX O3 EUs must be <0.003 ppm.

Figure E.1.2.1-2. Ozone Multipoint Calibration Summary.

E.1.2.3 Instrumentation Information

E.1.2.3.1 Complete the Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators (see Figure E.1.1.2-1) and the top section of Ozone Multipoint Calibration Summary (see Figure E.1.1.2-2). Fill in the site name, date, operator (first initial and full last name), and chart formula. Please note that the transfer standard sample flow cannot be recorded until a calibration event is activated (see Sub-section E.1.2.4.1).

E.1.2.3.2 Complete the INSTRUMENTATION INFORMATION section of the Ozone Multipoint Calibration Summary. This information is similar to the information required on the Weekly Station Checklists. For assistance, please refer to Section B, Weekly Station Checklists, or call the OSC.

E.1.2.4 CAL POINT #1 (ppm range zero)

E.1.2.4.1 Activate Event 02, the Ozone Zero, using the SumX data logger by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	02 <ENTER>

NOTE: Immediately you should notice the activation of the pumps in the ML 8550 as evidenced by the upscale response of the flow rotometer on the front of the calibrator. This flow reading should be recorded on the Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators in the "CAL POINT #1" block.

E.1.2.4.2 Mark the strip chart indicating the time, date, "begin ozone multipoint calibration", and your first initial and last name. Note in the Station Log Book the time that the event was activated and that the ozone multipoint calibration has begun.

E.1.2.4.3 When the strip chart has stabilized (approximately 5 minutes), begin recording the readings from the front panel displays of the ozone analyzer and the ozone transfer standard and the SumX data logger engineering units (EUs) on the Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators once every minute for the next 5 minutes.

To obtain SumX data logger engineering units, perform the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	M
VIEW COLUMN NUMBERS	01 (O3) 02 (CAL)<ENTER>

NOTE: Hit the space bar several times to get one minute read-outs. Pressing F5 (ECHO) will allow for these values to be printed.

E.1.2.4.4 Once each minute for five consecutive minutes, record the following in the CAL POINT #1 section of the Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators:

- The number displayed on the front of the analyzer (OZONE CONCENTRATION PPM) under the ANALYZER DISPLAY column on the data worksheet
- The number in the O3 column displayed on the keyboard under the SUMX 03 EUs column on the data worksheet
- The number displayed on the front of the ozone transfer standard under the transfer standard DISPLAY column on the data worksheet
- The number in the CAL column displayed on the keyboard under the SUMX CAL EUs column on the data worksheet

E.1.2.4.5 Average out each column on the data worksheet and record in the row labeled MEAN (average).

E.1.2.4.6 Record the strip chart percentage and calculate and record the chart PPM using the appropriate equation (the equation should be written on a label affixed to the chart recorder).

E.1.2.4.7 Transfer the information recorded in steps E.1.2.4.5 and E.1.2.4.6 to the Ozone Multipoint Calibration Summary.

E.1.2.4.8 Escape out of the M function by pressing <ESC>.

E.1.2.4.9 Deactivate Event 02, the Zero, by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)?	02 <ENTER>

NOTE: Immediately you should notice the de-activation of the pumps in the ML 8550 calibrator as evidenced by the sudden quietness in the monitoring shelter.

E.1.2.5 CAL POINT #2 (ppm range 0.380-0.420)

E.1.2.5.1 Activate Event 01. This is the normal span check event and should generate a concentration between 0.380 and 0.420. Event 01 is activated as follows:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	01 <ENTER>

E.1.2.5.2 Repeat steps E.1.2.4.3 through E.1.2.4.7 and record the results in the CAL POINT #2 section of the Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators and in the Multipoint Calibration Summary section of the Ozone Multipoint Calibration Summary.

E.1.2.6 CAL POINT #3 (ppm range 0.150-0.200)

E.1.2.6.1 Change the "ozone" intensity switch from 6 to 5. Make additional adjustments to either the "ozone" intensity switch and/or the "ozone" rotometer on the ML 8550 calibrator until the ML 8810 transfer standard indicates the desired concentration (0.150 ppm to 0.200 ppm).

E.1.2.6.2 Repeat steps E.1.2.4.3 through E.1.2.4.7 and record the results in the CAL POINT #3 section of the Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators and in the Multipoint Calibration Summary section of the Ozone Multipoint Calibration Summary.

E.1.2.7 CAL POINT #4 (ppm range 0.030-0.080)

E.1.2.7.1 Change the "ozone" intensity switch to a lower value. Make additional adjustments to either the "ozone" intensity switch and/or the "ozone" rotometer on the ML 8550 calibrator until the ML 8810 transfer standard indicates the desired concentration (0.030 ppm to 0.080 ppm).

E.1.2.7.2 Repeat steps E.1.2.4.3 through E.1.2.4.7 and record the results in the CAL POINT #4 section of the Ozone Multipoint Calibration Raw Data Worksheet for ML 8550 Calibrators and in the Multipoint Calibration Summary section of the Ozone Multipoint Calibration Summary.

E.1.2.8 CAL POINT #5 (Post-Calibration Zero Verification)

E.1.2.8.1 Escape out of the M function by pressing <ESC>.

E.1.2.8.2 Return the "ozone" intensity switch and the "ozone" rotometer ball height to their original values.

E.1.1.8.3 Deactivate Event 01, the Span, by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	<ENTER>
DEACTIVATE WHICH EVENT(S)?	01 <ENTER>

E.1.2.8.4 Activate Event 02, the Zero, by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>
ACTIVATE WHICH EVENT(S)?	02 <ENTER>

E.1.2.8.5 When the strip chart has stabilized (approximately 5 minutes), begin recording **ONLY** the SumX keyboard readings (do not record analyzer and calibrator displays) on the bottom of the data worksheet, once every minute for the next 5 minutes.

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	M
VIEW COLUMN NUMBERS)?	01 (O3) 02 (CAL)<ENTER>

NOTE: Hit the space bar several times to get one minute read outs.

E.1.2.8.6 Average out each row on the data worksheet and record at the end of the row in the column labeled MEAN.

E.1.2.8.7 Escape out of the M function by pressing <ESC>.

E.1.2.8.8 Deactivate Event 02, the Zero, by performing the following:

TRS KEYBOARD DISPLAY	OPERATOR KEY-IN
>	C
CODE:	NPSAIR
ACTIVATE WHICH EVENT(S) IN SEQUENCE?	<ENTER>

ACTIVATE WHICH EVENT(S)? <ENTER>

DEACTIVATE WHICH EVENT(S)? 02 <ENTER>

E.1.2.8.9 Record "On-Line" on the strip chart. Note in the Station Log Book the completion of the ozone multipoint calibration.

E.1.2.9 Linear Regression Analysis

A linear regression is a statistical method for finding a straight line that best fits a set of *x*,*y*- data. The straight line provides a relationship between the *x*- and *y*-variables: $y = mx + b$, where m is the slope and b is the *y*-intercept.

To calculate the linear regression, use the "SumX CAL EUs" and the SumX O3 EUs" values from the Ozone Multipoint Calibration Summary Form. Assign *x* to the SumX CAL EUs (independent variable) and *y* to the SumX O3 EUs (dependent variable). Enter only one set of zero values (CAL POINT 1) and the corresponding sets of values for CAL POINT 2, 3, and 4.

Phone the results of the calibration to the OSC for evaluation and discussion. If you are unable to do so, or do not have access to a calculator or computer program that will calculate the results of the linear regression analysis, the OSC will perform these calculations for you.

E.1.2.10 Sending Copies

Send the copy with the bi-weekly station visit report. Keep the originals at the station.